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Reaching the Water's Edge: Assessing Riverfront Accessibility in the Quad Cities Area

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REACHING THE WATER'S EDGE: ASSESSING RIVERFRONT ACCESSIBILITY IN THE QUAD CITIES AREA

by

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TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

LIST OF FIGURES – CONTINUED

Figure Page

ABSTRACT

The purpose of this research is to understand the level of access people in the Quad Cities community have to the Mississippi River. Specifically, this study explores how accessibility levels differ in the cities of Davenport, Bettendorf, Rock Island, and Moline. Also, it explores how the level of measured accessibility relates to the perceived image, use, and accessibility of the Mississippi River. Information about public accessibility comes from a newly created Mississippi River Accessibility Index (MRAI) and resident surveys.

The MRAI combines six indicators to measure accessibility to the river. Applying the indicators to the four cities, Moline ranked number one in having the best accessibility to the Mississippi River while Bettendorf ranked last. The cities of Davenport and Rock Island ranked two and three, respectively. Aligning with the index results, surveys showed that Moline residents have a higher level of perceived access to the river than residents in the other cities. In addition to perceived access, perceived image and use varied based on the city of residence. Concerning image, respondents used very different language in describing the Mississippi River, calling the River everything from “majestic” and “a national landmark” to “sick with pollution” and “smelly”. Despite some negative connections with the River, over eighty percent of all respondents (N=138) say they agree that their city is a “rivertown”.

INTRODUCTION

In many river towns across the United States, a slow transformation is taking place as aging and abandoned industrial infrastructure is being replaced by new riverfront uses. Consequently, the urban American riverfront has become a battleground, with municipalities, developers, and large corporations fighting over this contested land. Access to the riverfront offers different benefits for each one of these stakeholders such as potential development for cities, financial gains for developers, and transportation access for companies. Riverfronts also offer multiple benefits for the public such as priceless river views and abundant recreational opportunities. Yet, studies have shown that public interests and access are often overlooked in the waterfront development process (PPS 2014). Urban riverfronts are "usually occupied by flood control facilities, industries, or private buildings, which seriously influence public accessibility to river corridors" (Che et al. 2012, 81).

One region facing these problems is the Quad Cities Metropolitan Statistics Area (QCA) located on the Illinois/Iowa border. This Midwest metropolitan region is situated along the Mississippi River in the United States. Among the five major cities that make up the QCA, three of them use flood control levees that protect the cities from flooding. Simultaneously, the levees create a visual and physical barrier between the public and the river. In addition to flood control levees, industrial land uses along the Mississippi Riverfront limit access QCA residents. When several major farm-related industries went out of business in the 1980s, the work force abandoned the riverfront area, leaving the infrastructure behind. Private homes and lots also line much of the QCA riverfront.

Rivers provide social and emotional benefits for nearby citizens. Owen Manning (1997) describes the intangible qualities of rivers:

> Rivers are channels of water on a journey somewhere, and their appeal is above all in this sense of journeying, actual or symbolic, and in their contrast of manners—swift or slow, turbulent or calm, purposefully straight or lazily meandering—and the contrast of scene through which they pass (68).

Rivers have relaxing, soothing, and calming effects on individuals. Viewing and contemplating water is a leisure activity in itself. R. Timothy Sieber (1993) argues that this strong connection with water is a relatively new phenomenon. It is part of the "emerging public culture" (186). Historically, the waterfront was an "active, rough, gritty, working-class place", but now it has shifted to a place of leisure, recreation, and beauty (187). The less water has been used, the more it has become an "aesthetic object" (186). For many urban residents, the waterfront provides a comforting sense of place that sharply contrasts that of the working environment in the city.

Because each riverfront city has a unique physical setting and development history, access to the waterfront could be expected to differ from city to city. The purpose of this research is to understand the level of access people in the QCA have to the Mississippi River. Specifically, this study explores how accessibility levels differ in the cities of Davenport, Bettendorf, Rock Island, and Moline and also explores how the level of measured accessibility relates to the perceived image, use, and accessibility of the Mississippi River. The study is novel for its combined considerations of "measured accessibility," based on field observations and GIS data, and "perceived accessibility," based on survey responses from QCA residents.

Accessibility is assessed by three dimensions: physical, visual, and equal accessibility. All three play a critical role in public accessibility to the riverfront. Physical accessibility allows the public to use the river for recreation and enjoyment or to simply experience the "sensation of flowing water tugging at ankles" (Manning 1997, 69). Visual accessibility lets the public see the water, allowing them opportunities to connect with the river and create a positive, emotional bond with the river. Lastly, equal accessibility allows people of all backgrounds to enjoy the

riverfront. It is expected that the cities with a flood control levee, Rock Island and Bettendorf, will exhibit relatively low levels of accessibility to the Mississippi River corridor while the cities of Davenport and Moline will have high levels of accessibility to the river corridor because of these cities' public green spaces along the riverfront and their lack of a floodwall. Assuming low levels of accessibility relates to negative river perceptions, it is expected that residents of Rock Island and Bettendorf will report a more negative image of and less use of the Mississippi River compared to Davenport and Moline residents.

STUDY AREA

The Mississippi River is one of the world's major river systems. The river begins in Lake Itasca in northern Minnesota and empties into the Gulf of Mexico. The Mississippi River Watershed is the fourth largest in the world. It includes 31 states and approximately 1.2 million square miles (Carter 1970, 127; NPS 2014). The river is an important transportation corridor for the Midwest. About fifty-two percent of the nation's corn exports and forty-one percent of soybean exports are carried along the Mississippi River System (UMBRA 2014). Because it is a navigable transportation corridor, the Mississippi River is an ideal location for urban settlement developments. The Mississippi is heavily managed with a series of locks and dams to keep the corridor passable for transporting the grain and other goods and products produce near the river. Flooding of the river is also greatly managed. Flood control levees are used to protect cities, industrial infrastructure, and prime farmland along the riverbanks.

Historically, the river towns along the Mississippi River were bustling nodes of commerce and trade. Rail lines running parallel to the river connected manufacturing areas and warehouses to the river (Rice & Urban 2006). Nowadays, the economy of the American river towns is not booming like it once was; the classic working riverfront is gone. American river towns have faced economic downturn in recent decades which has led to a heavy loss of manufacturing jobs and population. Job opportunities and people have migrated from the urban core near the riverfront out to the suburbs on the fringe of the city (Moline & Mahaffey 2004).

The QCA is no exception to this trend. The region is a metro area of about 350,000 people, situated along the Illinois and Iowa banks of the Mississippi River (Figure 1). It contains the cities of Rock Island, Moline, and East Moline on the Illinois side and Davenport and Bettendorf on the Iowa side (Figure 2). In 1853, the first railroad bridge across the Mississippi

Figure 1: The Quad Cities, located in the Midwest Region

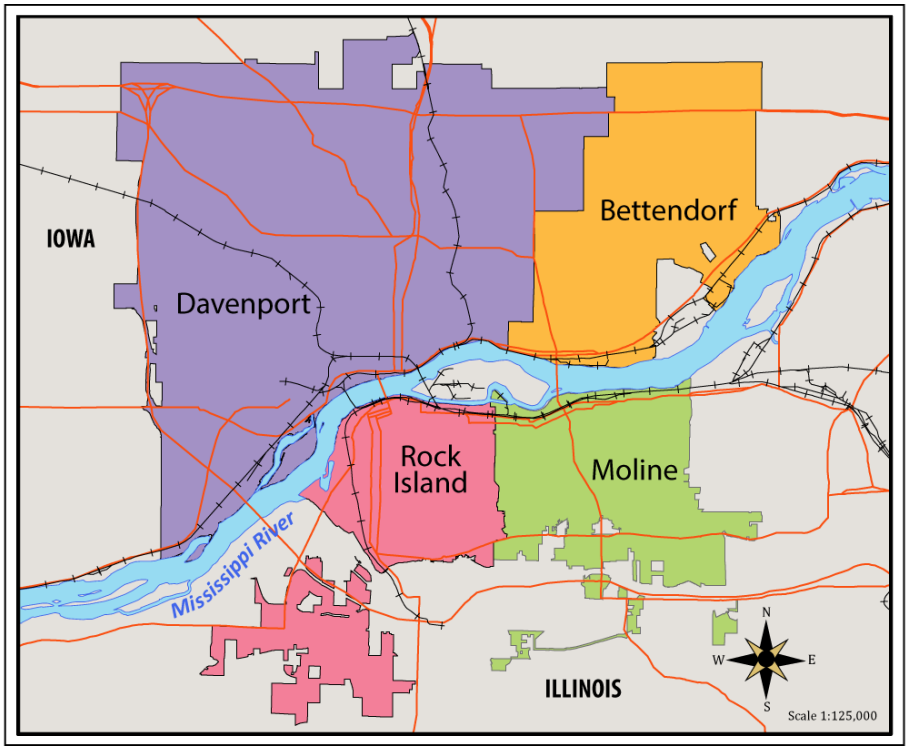

Figure 2: The Municipalities of the Quad Cities

River was built in the QCA. Through the early to mid-20th century, the region flourished as a "thriving center of commerce," with rail lines and vessels shipping goods along the Mississippi (Carter 1970, 79). But in the 1980s, the area was hit hard as several massive farm-related industries went out of business, putting over 20,000 people out of work (Moline & Mahaffey 2004). River towns throughout the Mississippi Watershed suffered in many ways including a dramatic increase in vacancies, high unemployment rates, a shrinking tax base, and "low morale" (194). The once bustling riverfronts in the Quad Cities became abandoned and started to decay.

In an attempt to bring vitality and economic activity back to the river, the individual municipalities of the Quad Cities tried different approaches to utilize, beautify, and embrace the Mississippi Riverfront. The cities hoped their efforts would encourage a population movement back to the city core along the river. Rock Island emulated development in Boston, MA and redesigned the "backs" of some downtown buildings to face the river and to orient people towards their riverfront. In an attempt to transform underutilized spaces, Rock Island opened Schwiebert Riverfront Park in 2010 (Figure 3). The goal of the park is to "bring people back to the riverfront and invigorate property values in the downtown" (SAA Design Group 2014). It features a riverfront promenade, an observation shelter, a spacious lawn for public events, and a water-splash playground. Adjacent to Schweibert is a newer, multifamily housing project called the Locks (Renaissance Rock Island 2014). However, Rock Island's flood control levee and railroad lines continue to create an effective physical and visual barrier between RI residents and the river.

The city of Moline, IL adaptively reused some of its old industrial buildings to bring people back to riverfront. John Deere Commons, a museum and commercial complex, is one

example of transforming old industrial infrastructure into a usable and viable space. Like Rock Island, Moline has also increased its green spaces along the river. The Ben Butterworth

Figure 3: View of the Mississippi River from the recreation path along Schwiebert Park

Parkway is a two-mile long park that is located along the banks of the river, giving the public direct physical access (Figure 4). A riverfront biking and recreation path runs right through the linear park, and two public boat launches are located in the park. Recent development is taking hold along this Ben Butterworth corridor including several housing complexes, a college campus, and retail businesses. Moline does not have a levee system, so the river can be easily seen from the streets, parks, and houses along the riverfront.

The city of Davenport, IA also does not have a levee along the Mississippi River. The city uses green spaces as a way to "control" flooding. This controversial approach gives the public greater physical and visual access to the river. One example of this green space is LeClaire Park, a waterfront park that has a "riverside walk, open green space, an outdoor concert site, and a minor league baseball stadium" (Moline & Mahaffey 2004, 195). Davenport boasts

long stretches of public space along the river. Credit Island, Centennial, LeClaire, Heritage, and Lindsey Parks are all Davenport riverfront recreational spaces (Figure 5). Casino riverboat

Figure 4: View of the Mississippi River from Ben Butterworth Parkway

Figure 5: View of the Mississippi River and Centennial Bridge from the recreation path in Davenport

gambling is another popular solution to the economic downturn in the Quad Cities. Rhythm City Casino is located in downtown Rock Island. An elevated-pedestrian bridge, The Skybridge, connects the downtown area to the river and park spaces along it. The city of Bettendorf, IA also has a riverfront casino named the Isle of Capri (Figure 6). Besides the casino and several scattered parks, Bettendorf has little development that draws people to the river. Most of the river's edge is mostly industrial, further limiting public access to the river.

Figure 6: View of the Isle of Capri casino from the recreation path atop the levee

The river has always been a central feature for river towns of the Quad Cities along the Mississippi River. However, there has been little regional effort to connect the people of the QCA to the river. Municipal boundary and river separation makes regional connectedness especially difficult. Activist organizations like River Action are committed to embracing the riverfront in the QCA and serving as a link between the river and the municipalities. The vision

statement of River Action focuses on “fostering the environmental, economic, and cultural vitality of the Mississippi River and its riverfront in the Quad City region” (River Action 2014). The study area for my research is confined to these municipalities of the QCA: Rock Island, Moline, Davenport, and Bettendorf.

LITERATURE REVIEW

Understanding *accessibility* is dependent upon the context in which it is used. Geographers tend to link land-use patterns and transportation systems with accessibility, but the definition can be broadened to include many other elements. This study measures accessibility through three components: physical, visual, and equal accessibility. In the literature, case studies around the world examine these components and apply them to local geographic areas (Sieber 1993; Gobster & Westphal 2004; Che et al. 2012). Access to features such as rivers has implications for the public. Humans attribute meaning, positive or negative, to the physical environment surrounding them. When good accessibility is maintained, positive place attachments are formed.

ACCESIBILITY: What is it?

Scholars have not been able to agree on a universal definition for *accessibility.* This discrepancy is partially because the term is discipline dependent. The concept of accessibility is widely used in many scientific fields, including transport planning, urban planning, and geography (Che et al. 2012). Geurs and Van Wee (2004) deem the concept to be misunderstood, poorly measured, and difficult to define. However, many well-known definitions for *accessibility* exist. Geurs and Van Wee (2004) define accessibility as "the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)" (128). This study will use Walter Hansen's (1959) more universal definition of *accessibility*: "the potential of opportunities for interaction." This definition does not limit accessibility to being concerned with the physical; it encompasses a temporal and a visual component as well.

Various factors can influence how accessible (as previously defined) a certain natural feature or a particular place of interest is. Land-use is a major factor in influencing accessibility. The amount, the spatial distribution, and the quality of land uses greatly affect accessibility (Geurs & Van Wee 2004). A downtown that incorporates mixed-land use development will most likely be more accessible than a downtown that is made up of strictly commercial development. The former fosters greater opportunities for interaction simply because mixed-land uses such as residential and commercial are within a much closer proximity to each other. Transportation is another influencer of accessibility. Access to multiple transportation modes allows people to "cover a distance between an origin and a destination" (128). Accessibility is dependent upon how efficient, how abundant, how expensive, and how timely transportation modes to the desired destination are. Also, a temporal component can influence accessibility. For example, businesses hours can limit or maximize opportunities for interaction. Finally, individual demographics and characteristics can influence accessibility such as owning or having access to a car, people's income, their household situation, and/or their education level. Geurs and Van Wee (2004) suggest that an accessibility measure should strive to take all these influences—land-use, transportation, temporal constraints, and individual demographics—into consideration.

ACCESSIBILITY: How is it measured?

Accessibility can be measured in multiple ways. Accessibility measures can be infrastructure-based, location-based, person-based, or utility based. Infrastructure-based measures are used to "analyze the performance or service level of transport infrastructure" (Geurs and Van Wee 2004, 128). Location based measures are used to "analyze accessibility at locations, typically on a macro-level" (129). This measure is commonly used in urban planning

and geographical studies and is the one used in this study. Person-based measures are used to "analyze accessibility at the individual level, such as 'the activities in which an individual can participate at a given time'" (129). Lastly, utility-based measures are used to "analyze the economic benefits that derive from access to the spatially distributed activities" (129).

Knowing which accessibility measures are appropriate for research is fairly straight-forward, but knowing which components and indicators to include for measuring accessibility are less so. Just as the definition of *accessibility* is tailored to a certain academic discipline, indicators of accessibility used in research studies are dependent upon the purposes and goals of the study. Based on the literature, the main, overarching components to include for a location-based measure of accessibility are physical accessibility, visual accessibility, and equal accessibility. *Physical accessibility* is the idea that land-uses, transportation modes, and public lands are situated in a way that allows the public to physically reach a certain destination. This research considers how physically accessible the Mississippi River is for people in the Quad Cities. A river should be physically accessible for recreational activities such as canoeing or rowing, agricultural livelihoods such as fishing.

Visual access to rivers is increasingly becoming a goal of urban planners and designers. Several scholarly sources stress the importance of *visual accessibility,* the idea that places such as buildings, land topology, and riverbanks are situated in a way that allows the public to view a certain feature (Sieber 1993; Manning 1997). Visual contact points, areas where the river is viewable, are "of focal importance" in urban areas (Manning 1997, 68). In one case study, the city of Boston, MA has made a goal to make the downtown development of the riverfront along the Harbor to not only allow people to see the river but to make them look at the water (Sieber 1993). The city focuses on the preservation of "view corridors" that keep spaces between

buildings and along the streets clear for viewing the water from further distances. Other ways that the city promotes views of the Harbor are having building features in Boston "promote or accentuate harbor views," having street furniture orient people to the water, and maintaining a continuous pedestrian walkway along the waterfront (176).

The final component of public accessibility for a location-based measure is equal accessibility. *Equal accessibility* is the idea that all people, regardless of residence, physical abilities, or financial resources, should have equal opportunities to access a place, specifically, access to a riverfront (Che et al, 2012). Riverfronts across America have seen struggles over public access. In Los Angeles, as in many places across the United States, these types of "rich environmental experiences are left to those who can afford to live close to nature" (Zell 2014). Fortunately, a recent trend of river towns is to create public waterfront parks and places so that the riverfront can be equally enjoyed by all residents and visitors. Los Angeles is working towards improving public accessibility to the Los Angeles River by restoring the natural river bed, revitalizing the riparian ecosystem, and constructing public walking paths along the riverfront. In New York City, miles of decaying, industrious waterfronts are becoming transformed into bikeways, parks, and other recreation developments in these underutilized areas (Martin 1999). However, Sieber (1993) argues that these public spaces are ironically being used most by affluent residents while the working class residents seem to be seeking out and enjoying underdeveloped sections of the waterfront that are often deemed as dangerous because they are not maintained.

PLACE ATTACHMENT: Beyond your doorstep

Accessibility to the waterfront is vital for creating positive place attachments with the river. When people can see the water, they are able to connect with it. As a Boston resident explains, “People can’t feel connected to the Harbor, can’t feel like they have access, unless they see the water” (Sieber 1993, 174). *Place attachment* is “a positive emotional bond” that individuals create between themselves and their environment (Mesch & Manor 1998, 504). For many reasons, people often form a place attachment with rivers, but the level of emotional attachment to rivers in American cities is greatly diverse. Of the many towns and cities that are adjacent to rivers, only some “face their rivers” (Rice & Urban 2006, 1). The river is either ignored or embraced by the city. When it is embraced, a sense of community identity with the river arises. Empirical evidence for this can be seen with business names that incorporate the river, real estate advertisements that boast spectacular river views, public parks that are meant to utilize river views and physical access, and festivals or annual celebrations that highlight the river as an iconic asset (Rice & Urban 2006).

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METHODOLOGY

Information about public accessibility comes from a newly created Mississippi River Accessibility Index (MRAI) and resident surveys. The MRAI combines several indicators to measure accessibility to the Mississippi River. This index was used to analyze the observed accessibility. The surveys gave a measure of perceived use, image, and accessibility of the cities that make up the Quad Cities Area.

A case study based in Minneapolis, MN served as a methodological framework for the MRAI (Petesch et al. 2013). In the study, six separate sections of the riverfront in Minneapolis were examined. Researchers collected quantitative data for twelve indicators of accessibility and use and then ranked the six sites in comparison with the others to determine the "most" and "least" accessible areas of the city to the Mississippi River. Several indicators from this study were applied to the QCA.

The MRAI in this study consists of three sub-indexes: A) physical accessibility B) visual accessibility and C) equal accessibility with six different indicators for assessing public accessibility (Table 1). Physical accessibility was measured based on the number of access points within each riverfront section and the percent of the population within specified distance buffers from the river. For this study, an "access point" is defined as a point where the public is allowed to launch boats into the Mississippi River. A River Action publication was used to locate the access points in Davenport, Bettendorf, Rock Island, and Moline (River Action 2014). The locations were confirmed by using both on-site observations and satellite imagery in Google Maps. For each city, the access points that fell within the municipal boundary were counted and recorded (Appendix A). To determine how the city's population is situated along the river, block population data was used (Appendix B). The population data was clipped to specified distance

buffers. The four distance buffers were 0 to 0.5 mile, 0.5 to 1 mile, 1 mile to 1.5 miles, and 1.5 to 2.5 miles from the river. Population totals and percentages were calculated and recorded.

Table 1: Mississippi River Accessibility Index (MRAI)

Sub-index	Indicator
A. Physical Accessibility	1. Number of access points within each city
	2. Percent of population within distance buffers
B. Visual Accessibility	3. Amount of public recreational paths with direct river views
	4. Percent of population within the viewshed of the Mississippi River
C. Equal Accessibility	5. Percent of private and public land along the riverfront
	6. Amount of public bus routes within distance buffers

Visual accessibility of the Mississippi River was measured based on the amount of public recreational paths with direct river views and the percent of the population within the viewshed of the river (Appendix C). Several scholarly sources mention the importance of visual accessibility, but using indicators to measure visual accessibility is an innovative approach (Sieber 1993; Manning 1997). To determine which sections of riverfront paths have direct river views, field observations were taken by biking the riverfront trails in Davenport, Bettendorf, Rock Island, and Moline. A Global Positioning System (GPS) unit was used to record waypoints at each location where the river changed from becoming non-visible to visible and vice versa. The GPS waypoints were imported into ArcMap and overlaid with a shapefile of the riverfront trails. Line segments were created between waypoints, tracing along the riverfront trail lines, and were classified as either “visible” or “non-visible.” Distance totals and percentages were calculated and recorded. The second indicator for visual accessibility involved running a

viewshed analysis in the ArcMap software (Appendix D). Polygons created in this process were then clipped to the block population data. Population numbers within the viewshed of the river were calculated and recorded for each city.

Equal accessibility of the Mississippi River was determined by the percent of public and private land along the riverfront and the amount of public bus routes within distance buffers from the river. Parcel data was obtained for Davenport, Bettendorf, Rock Island, and Moline. From this layer, riverfront parcels were selected and exported into a new layer (Appendix E). Riverfront parcels were classified as either "private" or "public" based on several descriptive fields. For example, if the "property class" field was listed as "R"-residential-, then the parcel was classified as private. Once all parcels were classified, the lengths and percentages of private and public riverfront sections were calculated and recorded. The second equal accessibility indicator focused on evaluating transportation opportunities that could limit or maximize people's access to the river. For this indicator, public transit route layers were obtained from the Bi-State Regional Commission (Appendix F). The routes were clipped to each distance buffer. The amount of public transit routes for each city were calculated and recorded.

To analyze the data generated from the index, the cities were ranked in comparison with each other in each of the indicators.[i] Then, the rankings were summed to determine a comprehensive ranking of accessibility for the riverfronts of Davenport, Bettendorf, Rock Island and Moline.

The second part of the methodology consisted of surveys to reveal opinions, perceptions, and concerns that local property and business owners have about their accessibility to, image of, and use of the Mississippi River. The potential population for this study was limited to the population that lives within 2.5 miles from the river. A random stratified sampling method was

used to generate randomized addresses within each distance buffer for surveys to be sent. The computer program randomly selected the addresses of fifty properties in each distance buffer for all four cities, totaling 800 potential respondents. It was expected that there would be about a twenty percent respondent rate (N = 160).

A survey (Appendix G Appendix H) was sent out to each address. The first question asks participants to complete a sentence about what the Mississippi River is. The next section of the survey has participants rank the dimensions of the Mississippi River they think are most important. A similar method was used in a study by Paul Gobster and Lynne Westphal (2004). The third section of the survey asks participants to evaluate how often they participate in certain activities having to do with the Mississippi. The final section asks more subjective questions to discern how participants reportedly feel about the river and how satisfied they are with their access to the riverfront. Similar questions were used in public perception questionnaires from a 2013 study that was focused on enhancing the visual quality of city-river landscapes in the Lisbon metropolitan area (Batista e Silva et al. 2013).

The results of the questionnaires were analyzed using multiple methods. A scale was created to measure the level of perceived use, image, and accessibility of the Mississippi River. A case study in Shanghai created a similar scale that measured the level of accessibility and use to the Suzhou Creek at 48 sites (Che et al. 2012). Questions 1-6 are associated with *use*, questions 7-9, 15, and 17 are associated with *image*, and questions 10-14 and 16 are associated with *accessibility*. The responses for questions 1-5 were coded as “Never” = 0, “Several times a year” = 1, “Several times a month” = 2, and “At least once a week” = 3. Questions 9-15 were coded as “Yes” = 1 and “No” = 0. Question 16 was coded as “Easier” = 1 and “More difficult” = 0. The qualitative responses for questions 7 and 17 were coded separately. For question 7,

phrases and words were coded as a “negative image” or “positive image” of the river or a “neutral response”. Responses for Question 17 were grouped into repeating themed categories. Some categories, for example, were river recreation, the Lock & Dam, and restaurants and breweries.

After the results were coded, they were analyzed using Microsoft Excel software and illustrated using bar graphs, tables, and graduated color maps to show poor, fair, and great levels of perceived accessibility, use, and image of the Mississippi River. Analysis was also conducted to relate the “measured” accessibility levels generated from the index to the “observed” accessibility levels from the surveys.

RESULTS

The Mississippi River Accessibility Index (MRAI) measured accessibility to the Mississippi River for Davenport, Bettendorf, Rock Island, and Moline (Table 2). The cities were ranked in each of the six indicators with a 1, 2, 3, or 4, with 1 being the best and 4 being the worst.[ii] The rankings were averaged and assigned an overall ranking. Moline ranked number one overall while Bettendorf ranked last in accessibility, receiving a four. Davenport was second in overall accessibility to the river and Rock Island was ranked third.

Table 2: Ranking of Accessibility Indicators by City[iii]

	Davenport	Bettendorf	Rock Island	Moline
1. Number of Access Points	1	3[iv]	3	2
2. Population Distribution	4	3	1	2
3. Views from Recreation Path	1	4	2	3
4. Population Within Viewshed	4	3	1	2
5. Percent of Land Use Type	2	4	3	1
6. Amount of Bus Routes	1	3	4	2
Total of Rankings	**13**	**20**	**14**	**12**
Overall Ranking	**2**	**4**	**3**	**1**

For indicator 1—number of access points—cities were ranked based on the number of access points within each city boundary. Davenport was given a 1-ranking with four public access points being within the municipal boundary while Bettendorf and Rock Island received a 3-ranking with two public access points each (Table 3, Figure 7).

For indicator 2—population distribution in relation to the river—cities were ranked based on city populations within 1 mile. Rock Island has the highest percentage (forty-two percent) of its population living within one mile of the river (Table 4). Therefore, the city received a 1-rank. Davenport ranked last because the city has the lowest percentage living within one mile of the

Table 3: Public Access Points to the Mississippi River

City	Number of Public Boat Ramps
Davenport	4
Bettendorf	2
Rock Island	2
Moline	3

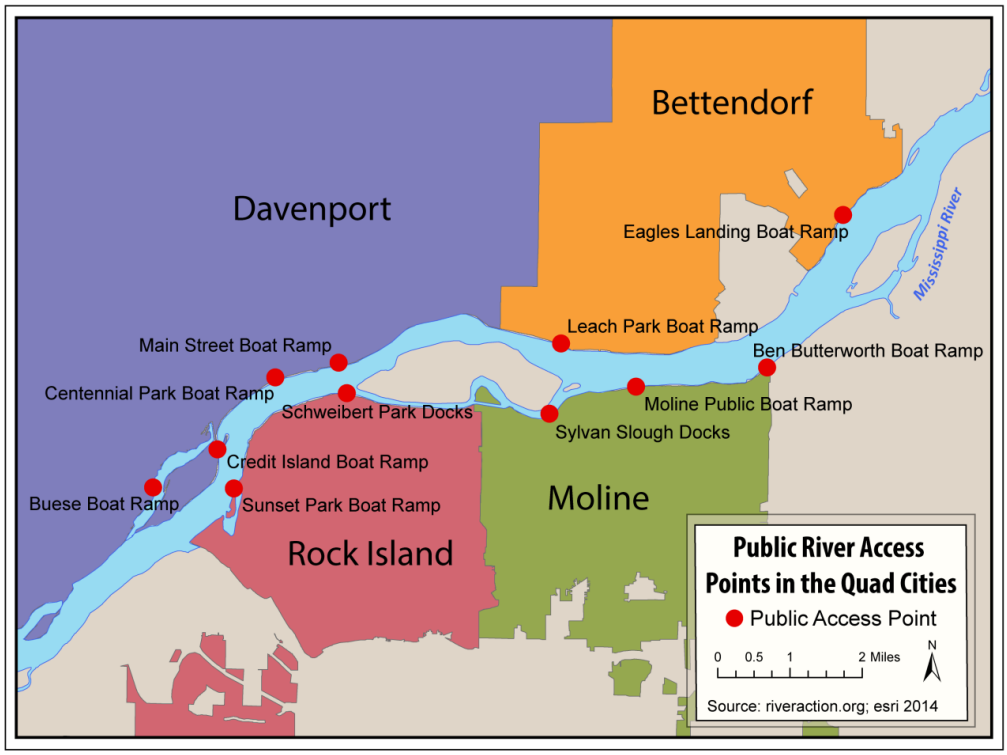

Figure 7: Public Access Points in the Quad Cities

river (24 percent). Davenport also has the highest percentage of people living in the furthest distance buffer from the river (Figure 8). Thirty-seven percent of the population lives at least 2.5 miles away from the Mississippi River. The populations of Moline and Bettendorf are less concentrated and more evenly distributed in relation to the river (Figure 9). The distance

Table 4: Population within Distance Buffers

City	Buffer[v]	Population	Percent
Davenport	A	8,293	7%
	B	20,906	17%
	C	18,340	15%
	D	28,152	23%
	E	44,768	37%
Bettendorf	A	4,023	8%
	B	10,613	20%
	C	9,601	19%
	D	14,646	28%
	E	12,999	25%
Rock Island	A	6,765	13%
	B	15,338	29%
	C	12,363	24%
	D	11,872	23%
	E	6,086	12%
Moline	A	7,614	12%
	B	13,555	21%
	C	14,666	23%
	D	15,564	24%
	E	13,221	20%

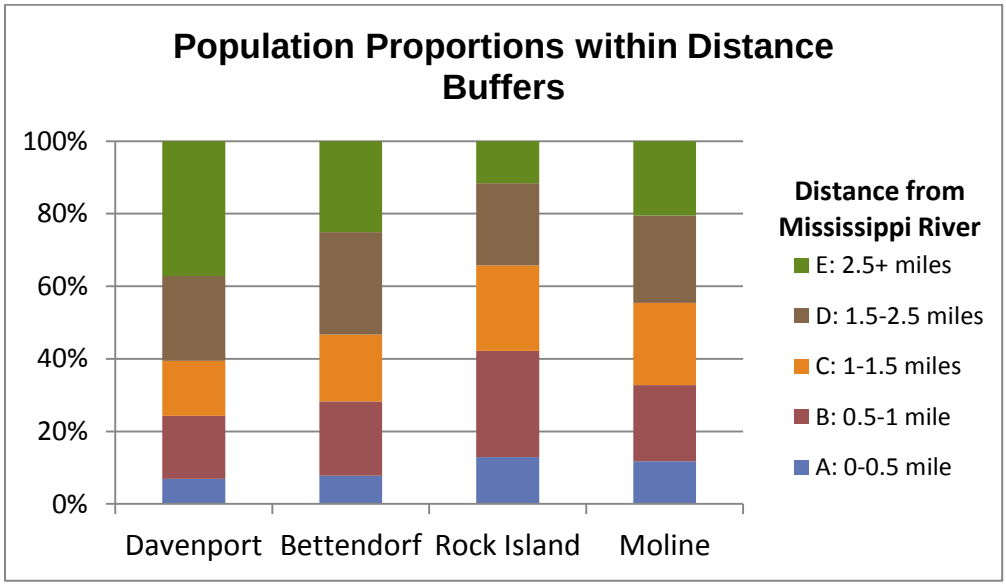

Figure 8: Population Proportions within Distance Buffers

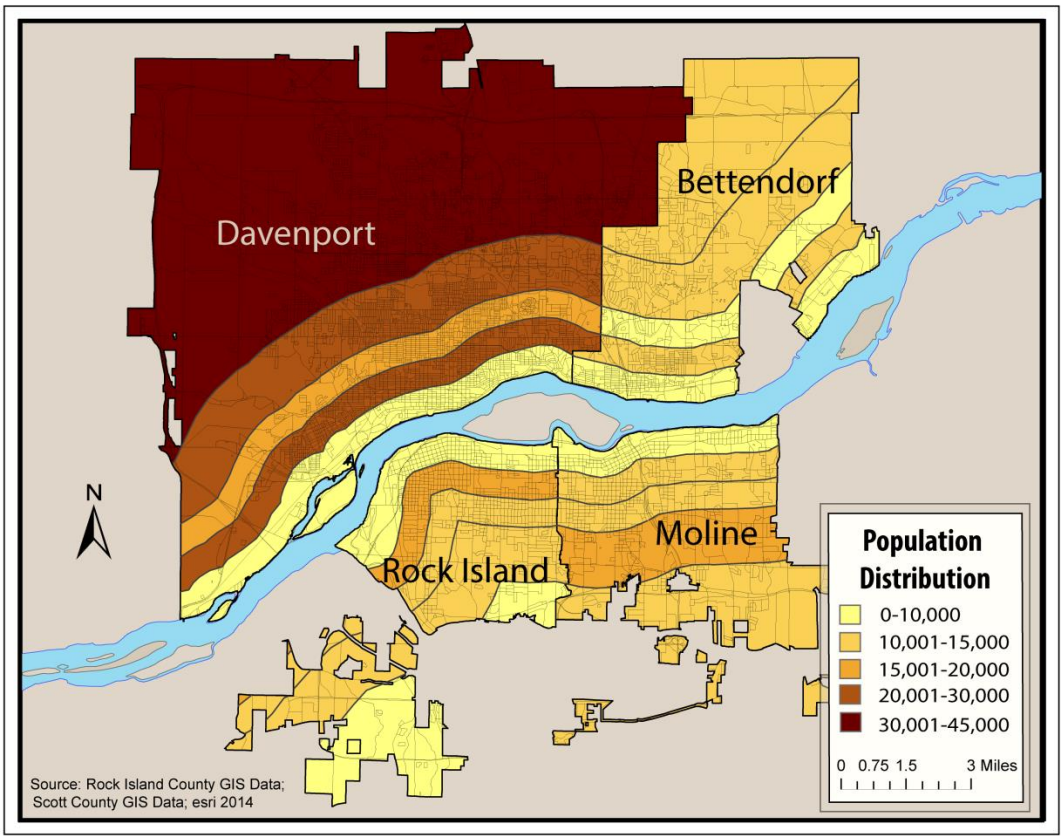

Figure 9: Quad Cities Population Distribution

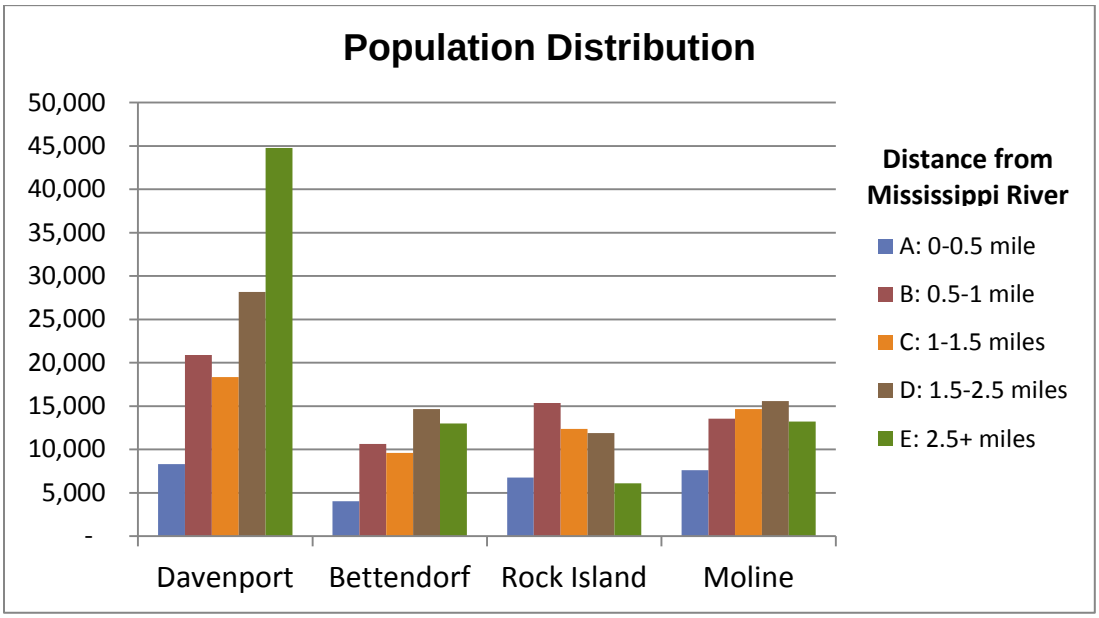

Figure 10: Population Distribution Based on Distance Buffers from the Mississippi River

buffer with the highest population is Buffer E in Davenport. About 45,000 people live in this buffer (Figure 10). The buffer with the least number of people is Buffer A in Bettendorf with approximately 4,000 people residing in this area.

For indicator 3—views from recreation paths—cities were ranked based on the percentage of the riverfront path with a direct view of the Mississippi River. Davenport ranked first for this indicator while Bettendorf ranked last. The river is visible from a majority of the length of riverfront paths in the four cities (Figure 11). In Davenport, a view of the Mississippi River can be seen on about ninety-one percent of the riverfront recreation path while only about sixty-seven percent of the path in Bettendorf has direct river views (Table 5, Figure 12). Davenport has the longest total length of riverfront recreation paths, totaling 25,831 feet (4.89 miles).

Table 5: Amount of Public Recreational Paths with River and Non-river Views

	River is Visible		**River is Not Visible**		Total Path Length (ft.)
	Length (ft.)	Percent of Total	Length (ft.)	Percent of Total	
Davenport	23,589.82	91.33%	2,240.68	8.67%	25,830.51
Bettendorf	10,886.92	66.81%	5,408.90	33.19%	16,295.82
Rock Island	17,286.24	75.21%	5,698.55	24.79%	22,984.79
Moline	17,074.05	71.79%	6,710.72	28.21%	23,784.78

For indicator 4—population within the river viewshed—cities were ranked based on the percentage of their population within the viewshed of the Mississippi River. Rock Island received a 1-ranking, and Davenport received 4-ranking. Twenty-two percent of Rock Island's population resides within the Mississippi River viewshed (Table 6, Figure 13). Davenport has twelve percent of its population within the river viewshed. The cities of Davenport, Bettendorf,

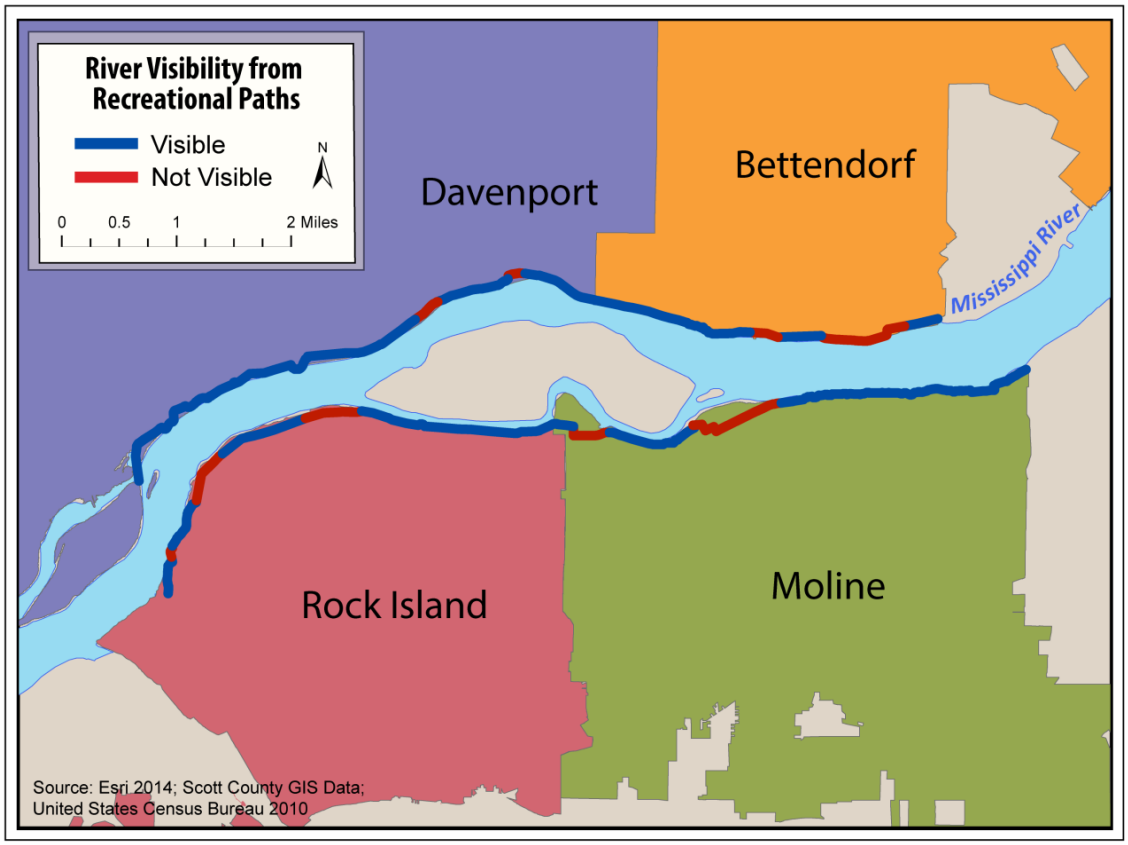

Figure 11: River Visibility from Public Recreational Paths Along the Mississippi River

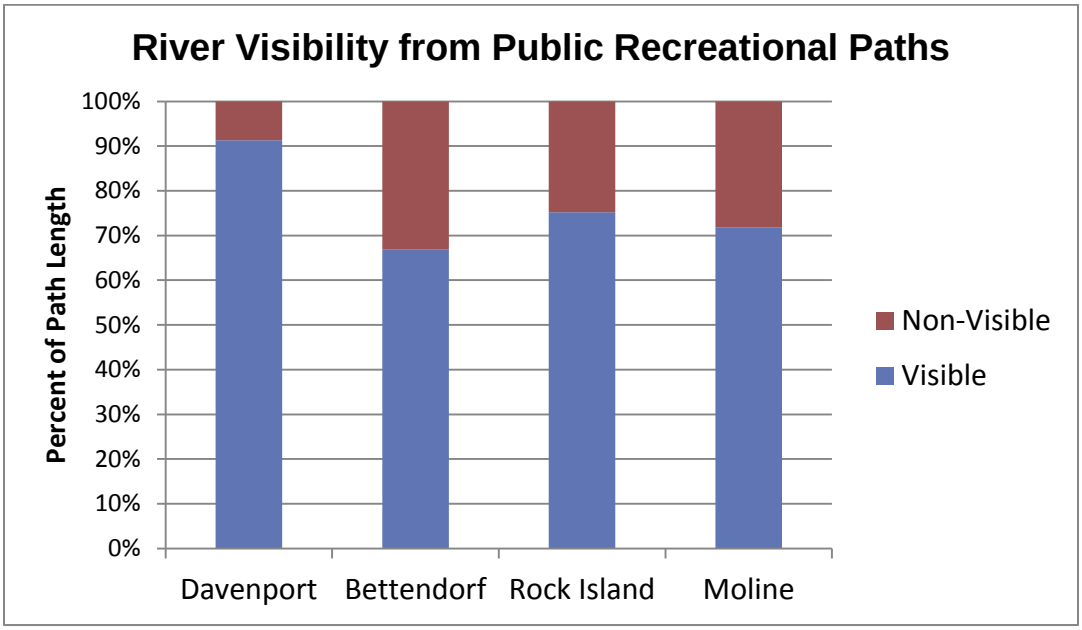

Figure 12: River Visibility from Public Recreational Paths

Table 6: Visibility of the River for City Populations

City	Population		Total Population	Percentage Visible
	Visible	Not Visible		
Davenport	12,257	89,261	101,518	12.07%
Bettendorf	4,201	30,485	34,686	12.11%
Rock Island	9,016	32,500	41,516	21.71%
Moline	6,588	42,392	48,980	13.45%

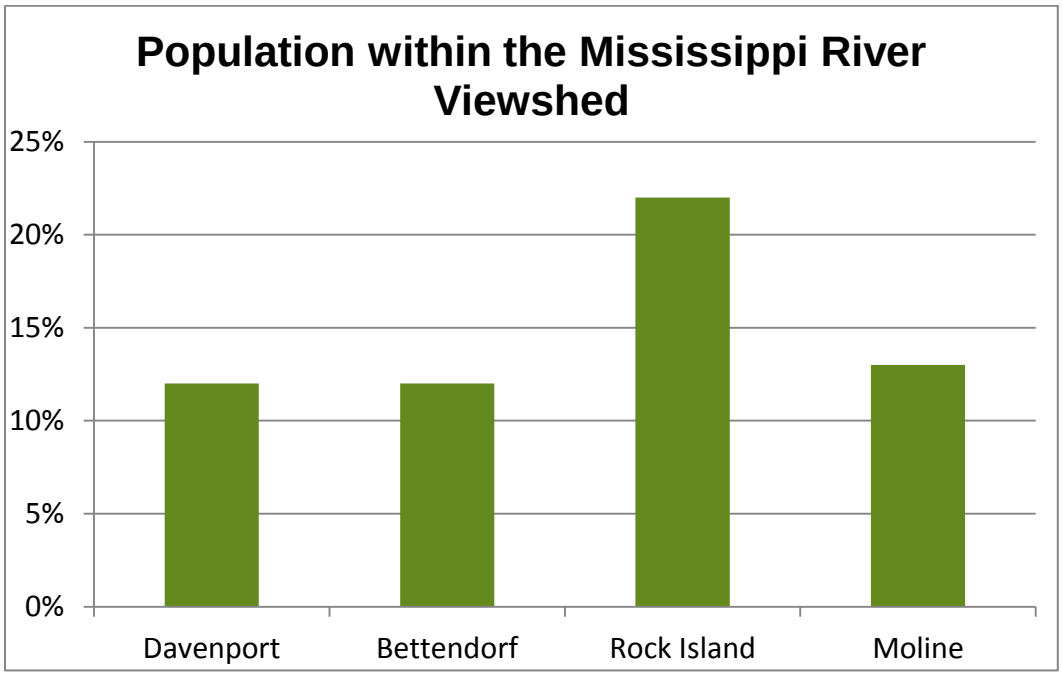

Figure 13: Percentage of City Populations within the Mississippi River Viewshed

Bettendorf, and Moline have relatively similar proportions of the population within the viewshed, but Rock Island has almost twice the percent of its population living in the viewshed than the other cities (Figure 13). Figure 14 geographically shows the areas that fall within the Mississippi River viewshed.

For indicator 5—percent of riverfront land use type—cities were ranked based on the percentage of public land along the riverfront. This indicator is the only one that gave rankings

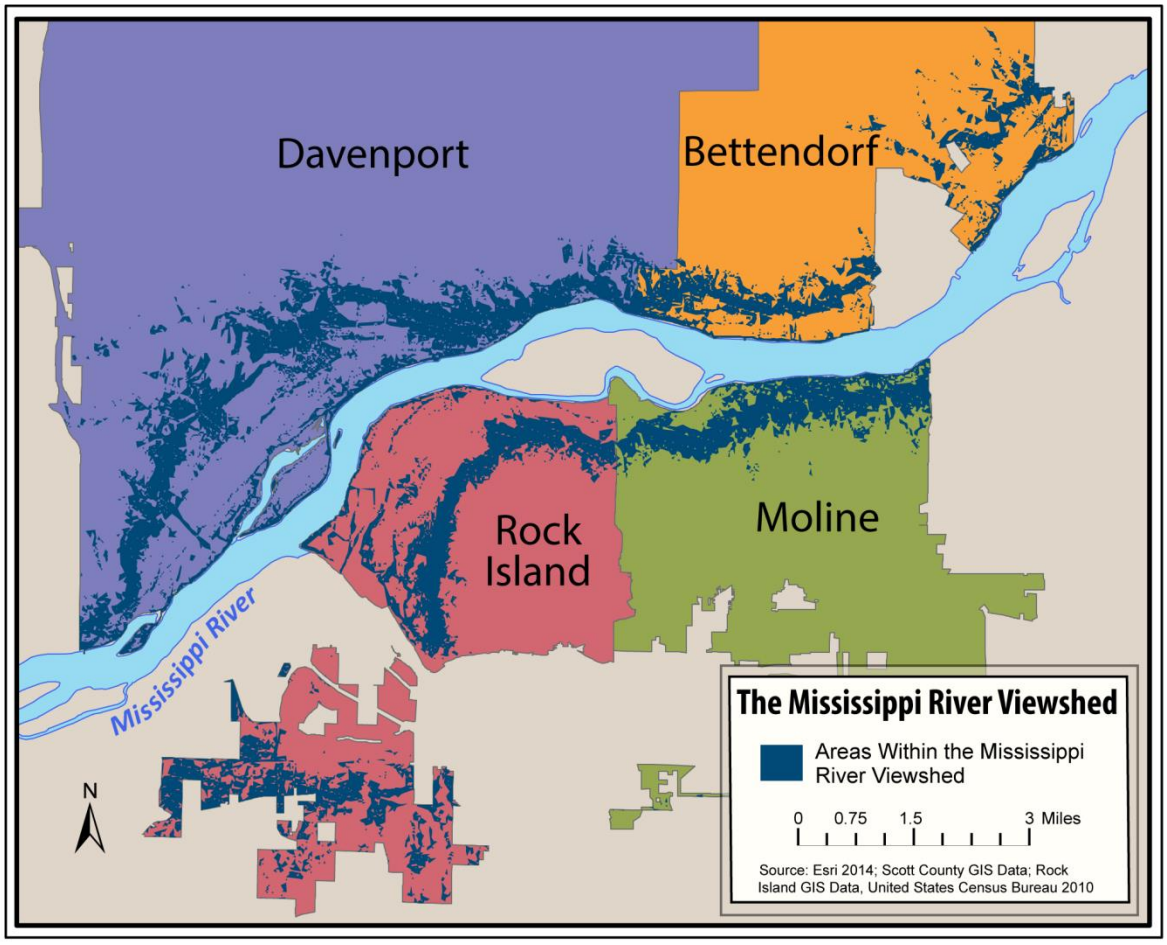

Figure 14: Areas within the Viewshed of the Mississippi River

Table 7: Land Use Type along the Riverfront

	Riverfront Length (mi.)				
	Public	% of Total	**Private**	% of Total	Total
Davenport	4.83	53%	4.24	47%	9.07
Bettendorf	1.61	32%	3.45	68%	5.06
Rock Island	1.82	36%	3.18	64%	5.00
Moline	2.94	68%	1.37	32%	4.31

that aligned with the overall rankings of measured accessibility (Table 2). Consequently, Moline has the highest percent of public land along the riverfront with sixty-eight percent while Bettendorf has the lowest percent with thirty-two percent (Table 7, Figure 15). The longest continuous stretch of public riverfront land is in Davenport (Figure 16).

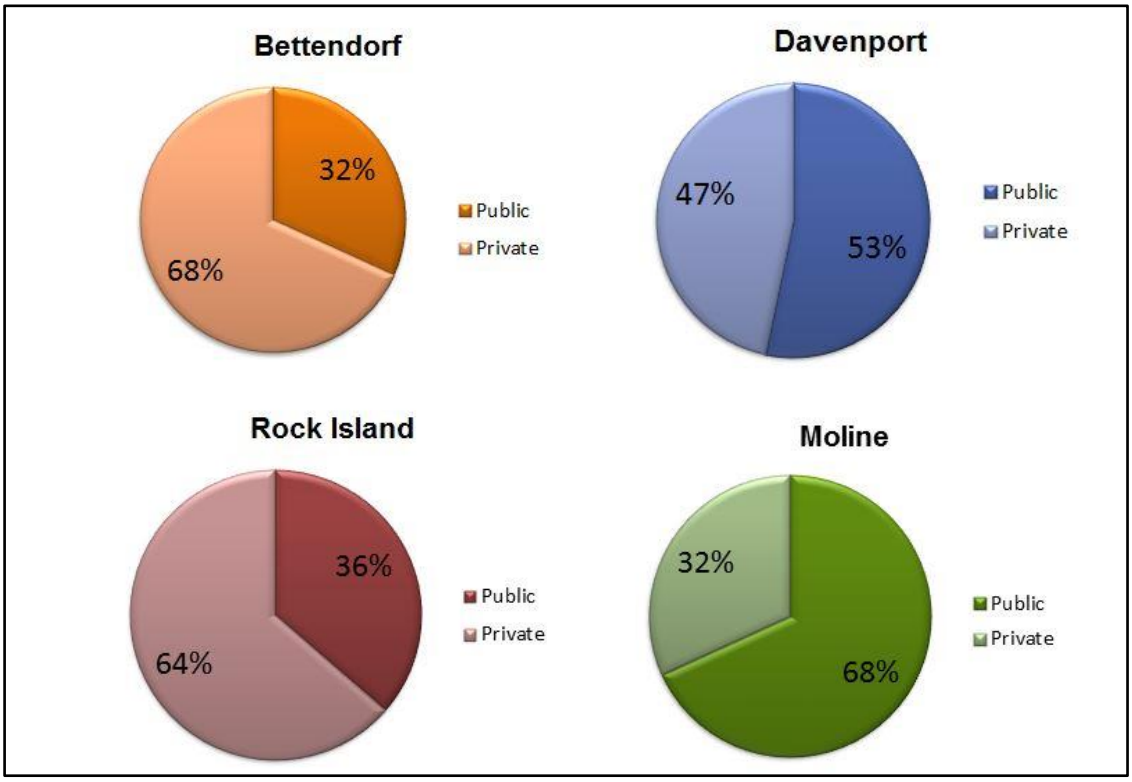

Figure 15: Riverfront Land Uses for each City

For indicator 6—amount of bus routes— cities were ranked based on the mileage of bus routes within one mile of the river. Davenport leads the cities for this indicator with 55.7 miles of bus routes being within one mile (Table 8). Rock Island has the least mileage of bus routes (19.1 miles) within one mile of the river. While Davenport has the most mileage of bus routes within one mile, the city has the lowest percentage of its total bus route mileage within the one mile

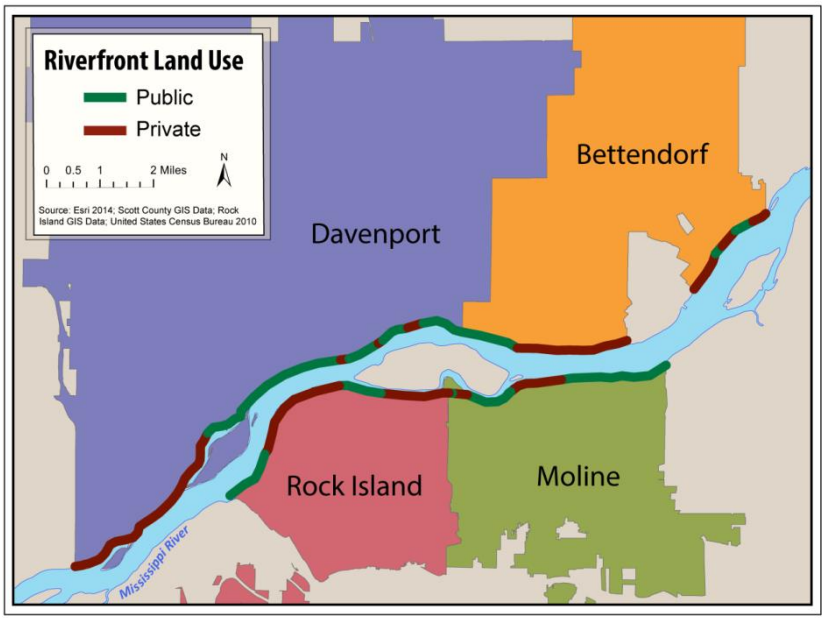

Figure 16: Public and Private Land along the Mississippi Riverfront

Table 8: Public Bus Route Lengths within Distance Buffers

City	Buffer[vi]	Length (mi.)	Percent
Davenport	A	28.3	14%
	B	27.4	13%
	C	23.8	12%
	D	48.6	24%
	E	76.1	37%
Bettendorf	A	12.3	31%
	B	8.0	20%
	C	4.1	10%
	D	11.3	29%
	E	3.4	9%
Rock Island	A	9.7	20%
	B	9.4	19%
	C	8.8	18%
	D	12.0	24%
	E	9.2	19%
Moline	A	18.4	27%
	B	5.6	8%
	C	8.8	13%
	D	5.9	9
	E	30.1	44

buffer (Figure 17, Figure 18). Public bus routes in Davenport are concentrated away from the river in Buffers D and E. To contrast, a relatively large percent of the bus routes in Bettendorf and Moline are concentrated within the a half of a mile from the river (Figure 19).

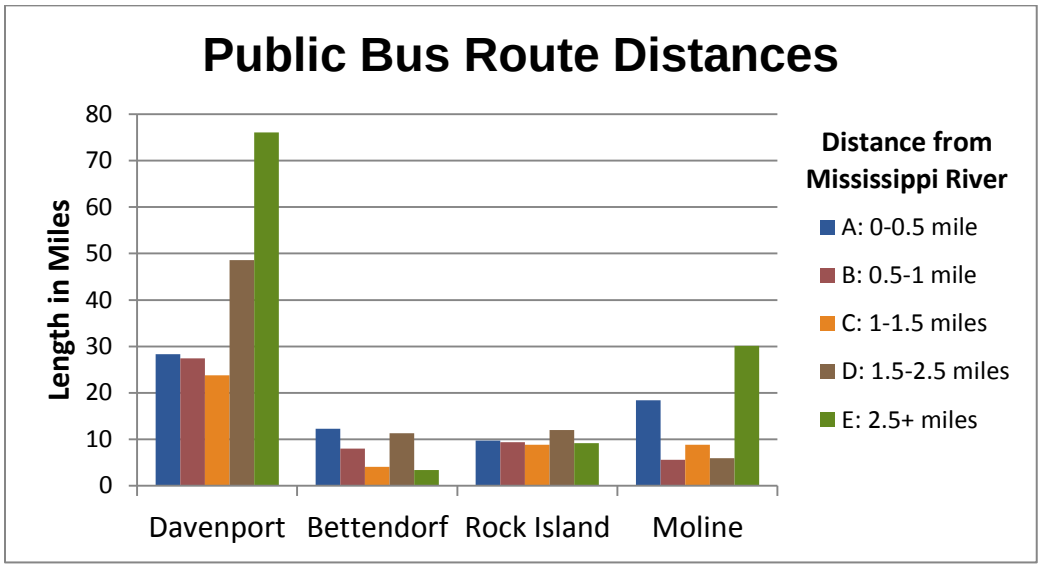

Figure 17: Bus Route Distances (in miles) within Distance Buffers

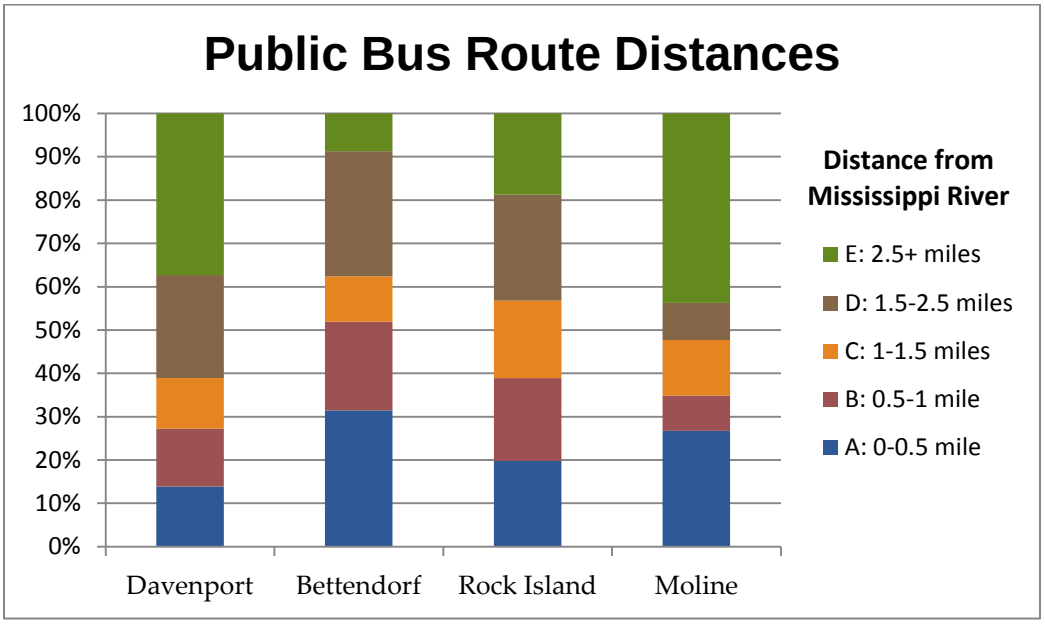

Figure 18: Bus Routes within Distance Buffers

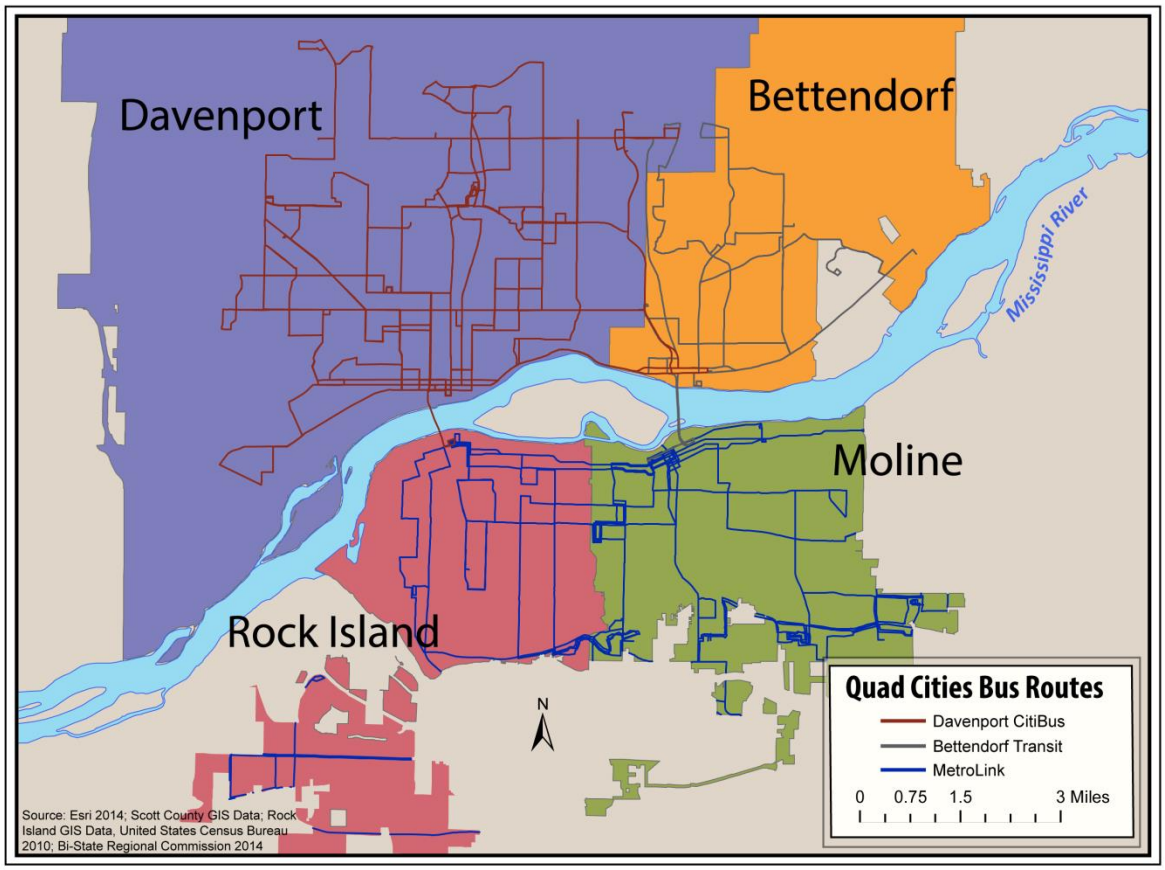

Figure 19: Public Bus Routes in the Quad Cities

Of the 800 surveys sent to residents in the Quad Cities, 140 were completed and sent back. Fifty respondents are from Bettendorf, thirty-one from Davenport, thirty-two from Moline, and twenty-seven from Rock Island. The average age of the participants is fifty-eight years old, and the average length of residency in the Quad Cities is thirty years. The median yearly income of the sample is $62,500.

Perceived use, image, and accessibility were calculated from the surveys. Perceived use was measured using coded responses from questions 1-5. These questions asked how often the respondent was most likely to participate in a certain river related activity such as using the public parks along the riverfront. Responses were coded as “Never” = 0, “Several times a year”

= 1, “Several times a month” = 2, and “At least once a week” = 3. The cities all reported very similar levels of use (Table 9). Rock Island had the highest rating of “average use” with 2.341 and Moline had the lowest with 2.178. These numbers show that Quad Cities residents report they are using the river in some way at least several times a month. Residents from all four cities reported that they drive over the river more frequently than participating in the other river activities. Visiting a public park along the river was the second most frequent river activity, as reported by respondents.

Table 9: Perceived Use of the Mississippi River[vii]

City	Path Use (Q1)	Restaurant Use (Q2)	Driving Use (Q3)	Park Use (Q4)	Other Use (Q5)	Average Use
Davenport	1.742	1.806	3.097	2.290	1.968	**2.181**
Bettendorf	2.120	2.100	3.265	2.120	2.020	**2.325**
Rock Island	1.963	1.889	3.630	2.222	2.000	**2.341**
Moline	2.000	1.806	3.406	2.000	1.677	**2.178**

Perceived image was measured using coded responses from questions 7, 9, and 15. These questions ask about general perceptions that deal with the “image” of the Mississippi River. The three questions were coded as either being a positive response or negative response concerning the image of the river. Table 10 lists the number of positive and negative responses for each question. Bettendorf residents reported having the most positive image of the river with a positive to negative ratio of 2.871. Although Rock Island residents reported having the most negative image of the river with a ratio of 1.696, all four cities had a more positive image of the river than a negative one.

Perceived accessibility was measured using coded responses from questions 12 and 16. Similar to the measure of perceived image of the river, this measure coded the responses as

Table 10: Perceived Image of the Mississippi River[viii]

	Q7		Q9		Q15		Totals		Overall
Image	+	-	+	-	+	-	+	-	**Image (+/-)**
Davenport	12	5	27	3	17	13	56	21	**2.667**
Bettendorf	18	6	40	9	31	16	89	31	**2.871**
Rock Island	7	2	19	8	13	13	39	23	**1.696**
Moline	18	3	27	4	14	15	59	22	**2.682**

Table 11: Perceived Accessibility of the Mississippi River[ix]

	Q12		Q16		Totals		Overall
Accessibility	+	-	+	-	+	-	**Accessibility (+/-)**
Davenport	19	11	26	2	45	13	**3.462**
Bettendorf	36	14	29	19	65	33	**1.970**
Rock Island	20	6	16	7	36	13	**2.769**
Moline	28	3	29	0	57	3	**19.000**

either being a positive or negative response. The cities displayed much greater variation for perceived accessibility than use or image (Table 11). In particular, Moline had a positive to negative response ratio of 19.000, over five times greater than the ratios of the other three cities. For question 16, one-hundred percent of Moline respondents reported that the river is easier to access compared to the other cities in the QCA. Bettendorf residents reported the lowest levels of accessibility with a positive to negative ratio of 1.970.

In-depth analysis was done on several questions. Perceived use is represented by question 6 concerning visiting the city riverfronts (Figure 20). Davenport's riverfront was reported as the most visited by Quad Cities residents. Twenty-seven respondents that were not from Davenport said they visit Davenport's riverfront most often. Bettendorf has the lowest number of net visitors. Of the fifty participants from Bettendorf, only half report that they visit Bettendorf's

riverfront most often. Based on participant responses, Moline has a net gain of visitors while Rock Island has a net loss of visitors to its riverfront.

Responses from question 7 represent perceived image of the Mississippi River. The responses were coded as positive, negative, or neutral (Figure 21). Examples of positive responses include “majestic”, “a national landmark”, and “a source of joy.” Several negative responses were “sick with pollution”, “filthy and smelly”, and “dangerous.” Neutral responses were either a combination of positive and negative phrases or responses such as “the only place where the Mississippi runs East and West.” Rock Island residents gave positive responses over three times more than negative ones (7:2), a higher ratio than the other three cities.

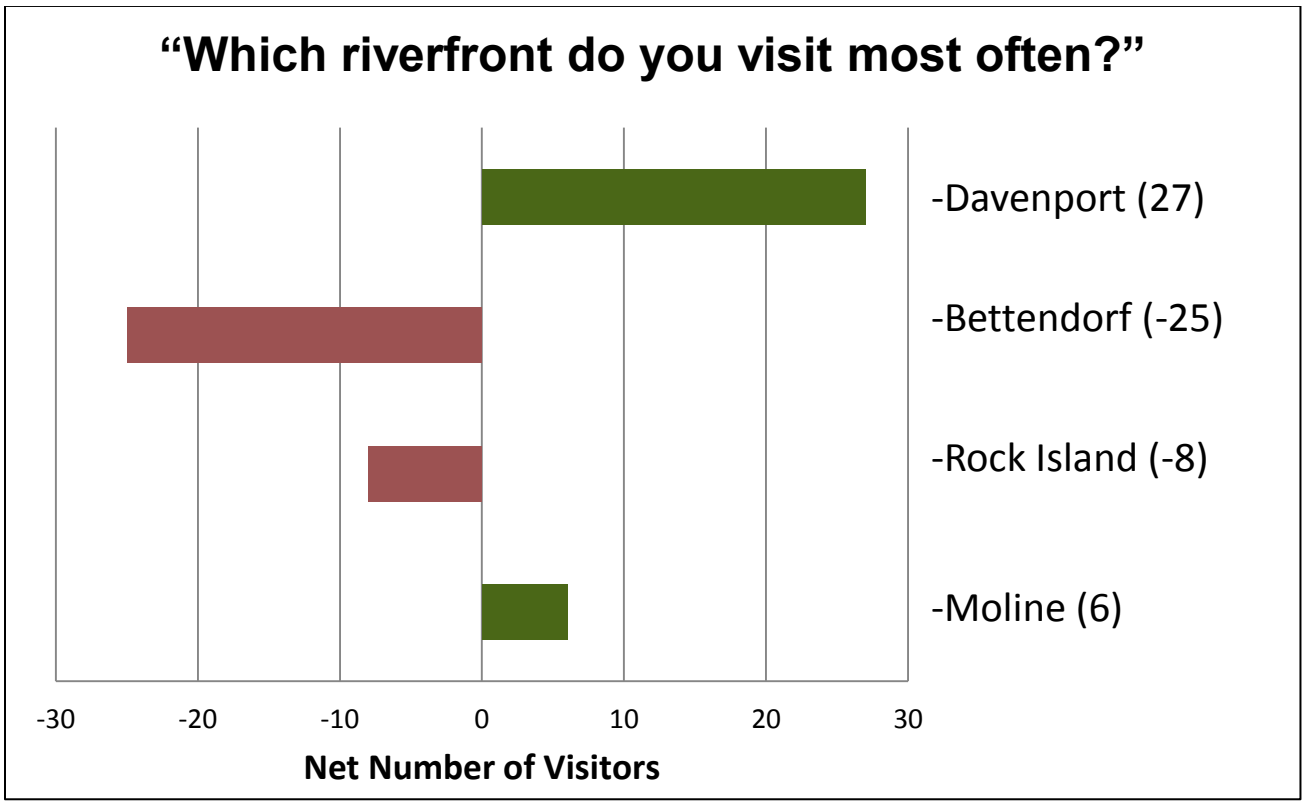

Figure 20: Survey responses to Question 6: “Which riverfront do you visit most often?” (N=132)

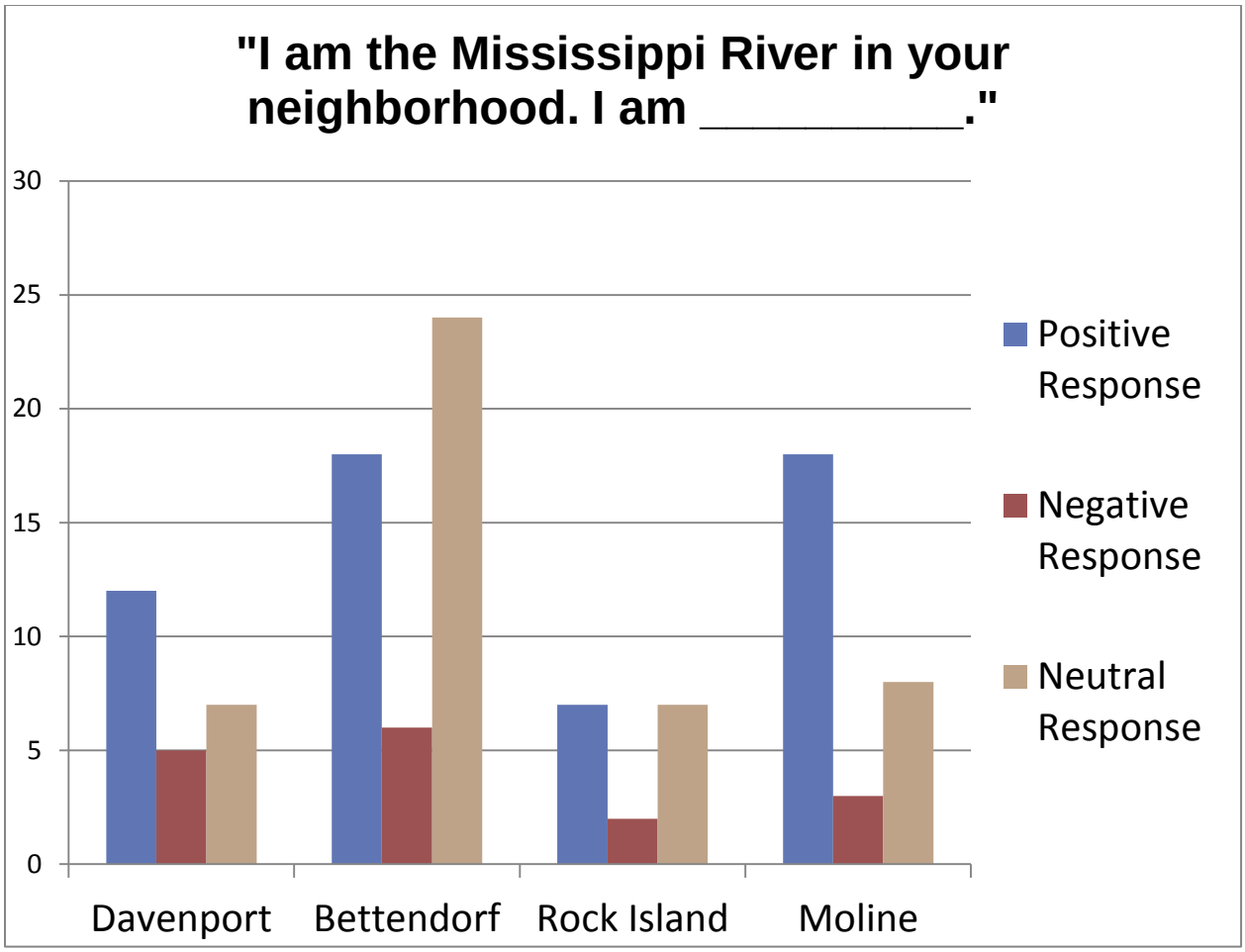

Figure 21: Survey responses to Question 7: "I am the Mississippi River in your neighborhood. I am _____." (N=118)

Perceived accessibility is represented by question 16 on the surveys. The majority of participants reported that the river was easily accessible in their city (Figure 22). All twenty-nine Moline respondents reported that the river is easier to access compared to other cities in the QCA. In contrast, nineteen participants from Bettendorf said the river is more difficult to access in their city compared to the other three cities in the QCA. Question 17 was also examined closely. River recreation of some kind was reported as the most popular destination for residents taking out-of-town guests (Figure 23). Visiting the Arsenal Lock & Dam, going to a particular

restaurant/brewery, and taking the Channel Cat Water Taxi were also frequent responses to this question.

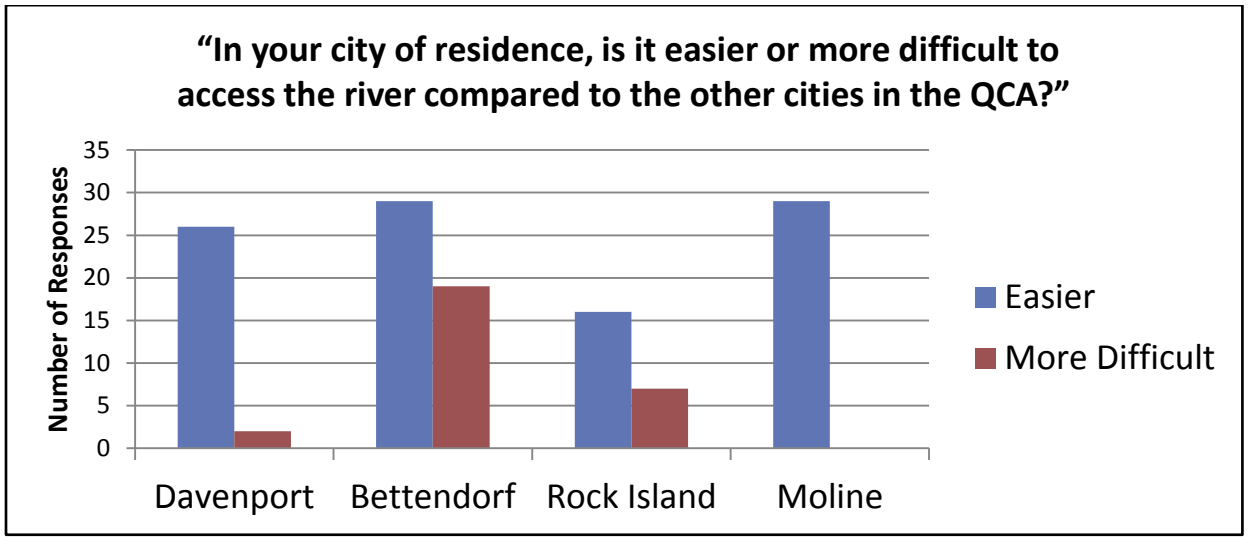

Figure 22: Survey responses to Question 16: "In you city or residence, is it easier or more difficult to access the river compared to the other cities in the QCA?" (N=128)

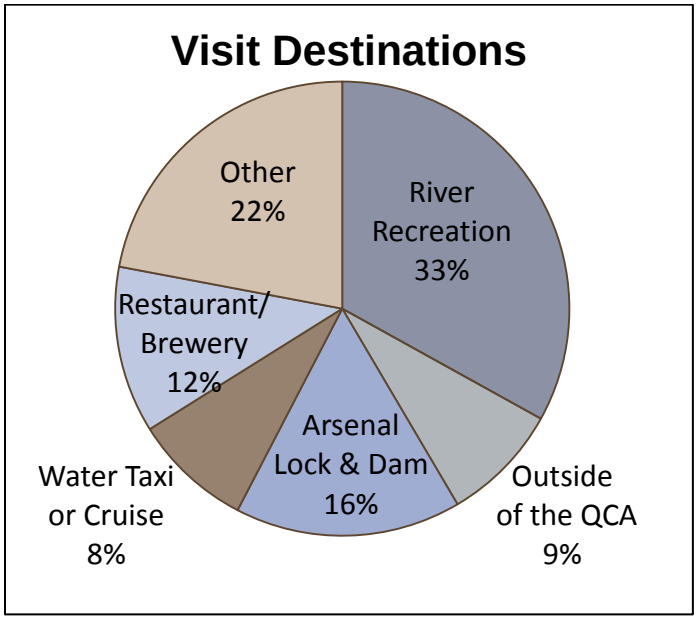

Figure 23: Survey responses to Question 17: "Where would you take someone visiting from out of town first?" (N=118)

DISCUSSION

People living in the Quad Cities are connected to the river. Most of the Quad Cities population identifies their city as a "rivertown." However, differing levels in accessibility were found across the four cities in this study. The results of this case study illustrate the strengths and weaknesses of the individual cities of the QCA concerning physical, visual, and equal accessibility.

The city of Davenport either scored very high or very low for the indicators (Table 7). Davenport scored high on the indicators dealing with riverfront land use and development along the river. The city is known for its entertainment and continuous green space along the riverfront, but physical access is limited because Davenport's population is concentrated in areas far away from the Mississippi River. About sixty percent of the population lives over 1.5 miles from the river (Table 2). To increase access to the river, Davenport should consider expanding residential development in the downtown areas and other areas within walking distance of the river.

Bettendorf scored low for all six indicators, receiving either a 3- or 4-ranking. The city scored low in physical, visual, and equal accessibility. Like Davenport, Bettendorf's population is concentrated in the northern outskirts of the city, away from the river. The Mississippi River is not easy to physically reach simply because the population lives far from the riverfront. The Bettendorf Riverfront is also not visually or equally accessibility because many industrial land uses block views and prohibit equal access for the public. Bettendorf should also consider expanding residential development closer to the river. Replacing industrial land uses or adaptively reusing unused spaces along the river could be another option for Bettendorf to increase overall accessibility to the Mississippi River.

Like Davenport, the city of Rock Island either scored very low or high for the indicators. But unlike Davenport, Rock Island scored low in indicators dealing with land use and development and high in indicators dealing with population distribution. While Rock Island has several popular riverfront parks such as Schwiebert Park and Sylvan Island, industrial and commercial land uses often block public access to the river. Rock Island tied with Bettendorf for having the least number of access points to the river and had the second lowest percentage of public land along the riverfront. However, Rock Island's population is concentrated along the Mississippi River. Developing more public spaces along the riverfront is something Rock Island could consider to increase accessibility levels to the river.

Moline consistently scored well for most all of the indicators in the MRAI. The city boasts the highest percentage of public land along the riverfront. Also, its population is relatively close to the river, and many bus routes run within one mile of the river. Moline received a 3-ranking for indicator 3 (view from recreation path) because of a couple stretches of commercial and industrial land uses along the riverfront. To improve visual access along the riverfront, Moline could implement the "step-down" approach used by Boston where infrastructure is built up, step-by-step, as it moves away from the river.

Perceived access, as reported by participants, aligns with the measured access, as calculated using the MRAI. As aforementioned, Moline has the greatest accessibility to the Mississippi River. Similarly, Moline residents reported higher levels of accessibility compared to the other cities. Both perceived access and measured access was lowest for Bettendorf. These findings show that Quad Cities citizens are aware of their access to the Mississippi River. Perceived image and use did not align as neatly with measured accessibility.

In response to this study, the targeted cities should feel obligated to maintain their accessibility levels if they scored well and try to increase their accessibility levels if they scored poorly on the accessibility index in this research. City planners, officials, and visionaries in the Quad Cities can use this data to improve riverfront accessibility. Good public accessibility has economic and social benefits for river cities, so city planners should be prioritizing the riverfront as "a general right of public access" in their future designs and plans (Manning 1997, 68). Going beyond the Quad Cities, the methodology used in this case study can serve as a model for measuring public accessibility in other river towns.

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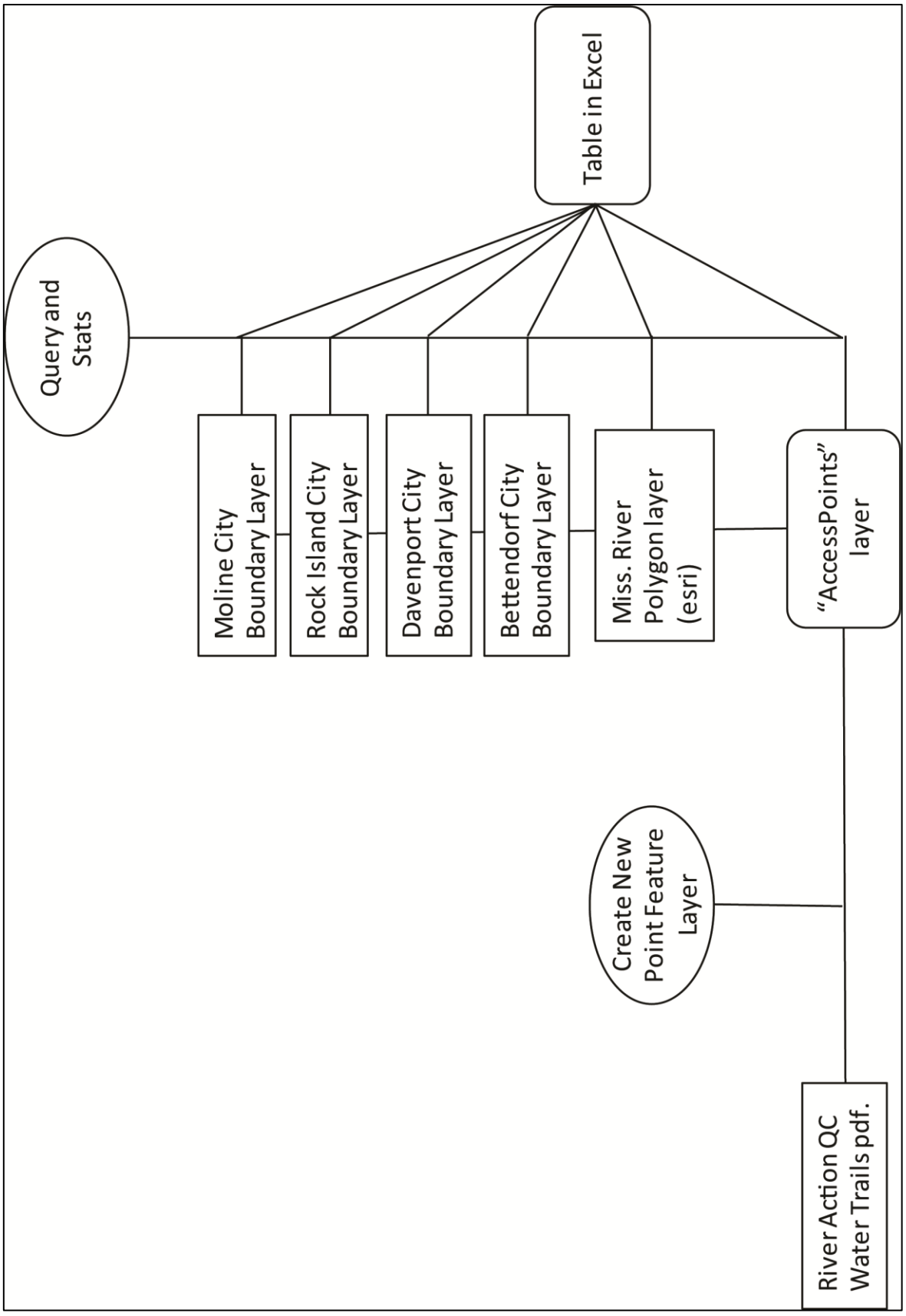
APPENDICES

APPENDIX A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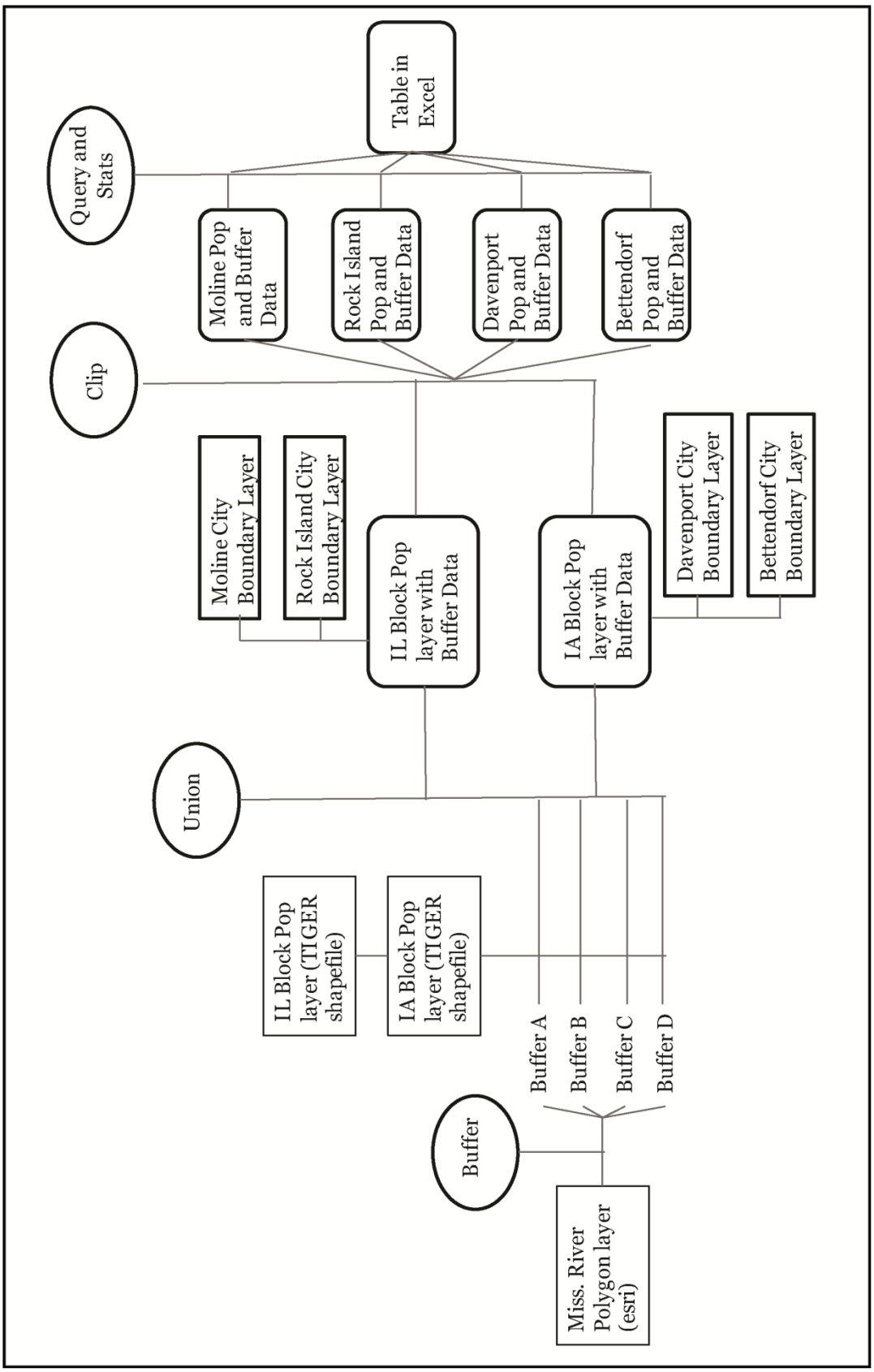
APPENDIX B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IL Block Pop layer with Buffer Data
Bettendorf City Boundary Layer
Davenport City Boundary Layer
Rock Island City Boundary Layer
Moline City Boundary Layer
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Query and Stats
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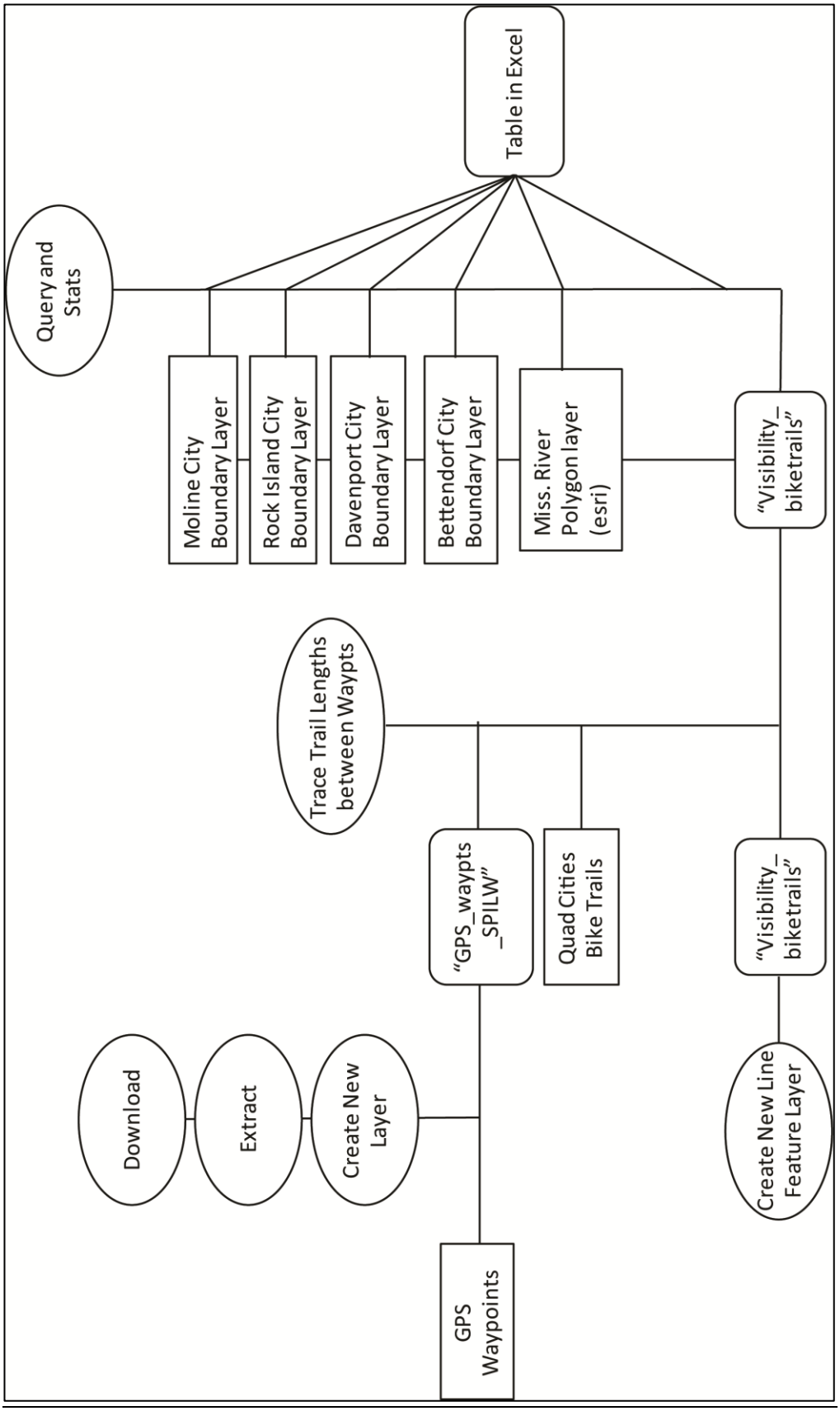
APPENDIX C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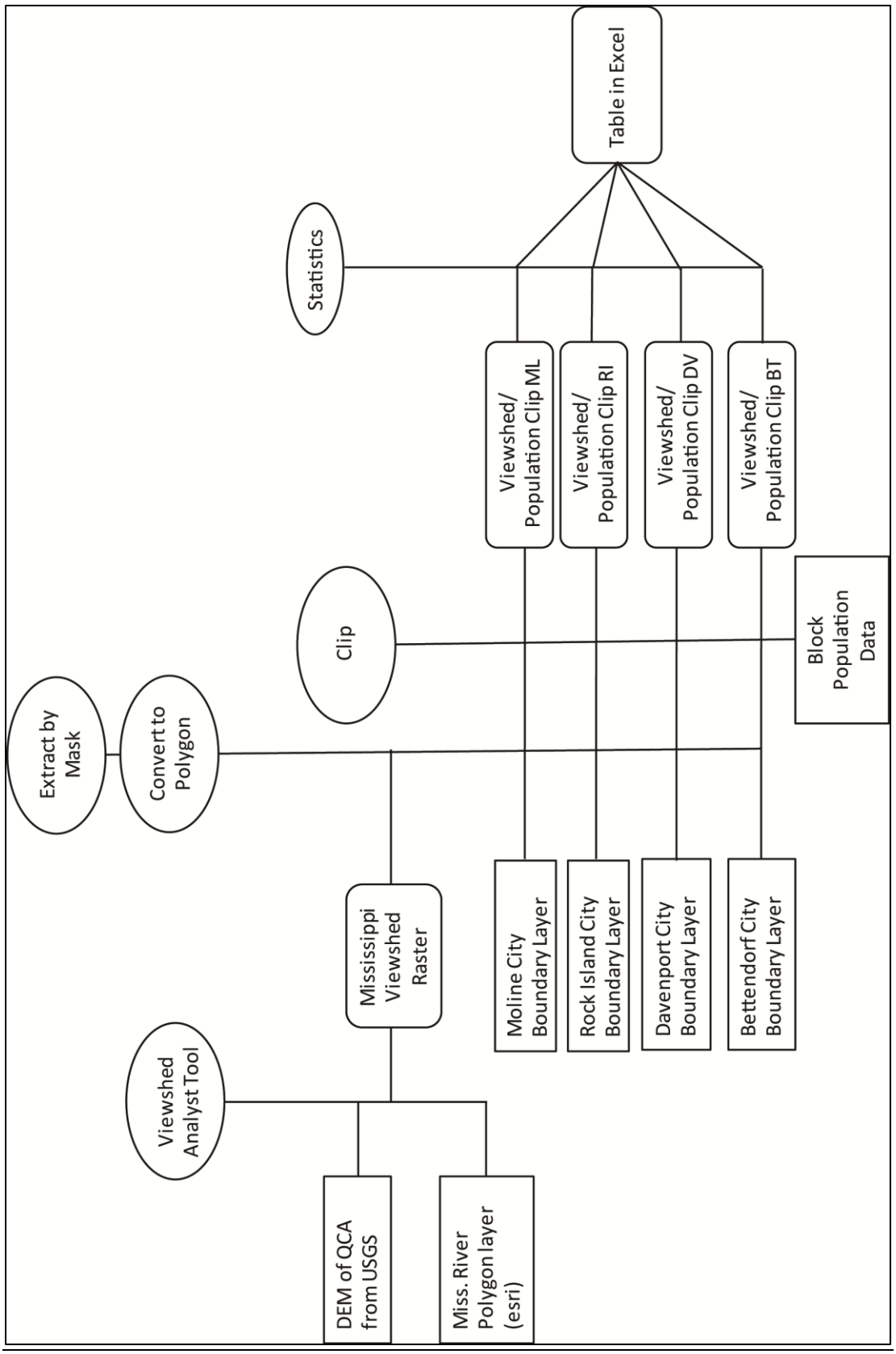
APPENDIX D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Bettendorf City Boundary Layer
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Block Population Data
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Viewshed/ Population Clip DV
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Statistics
Table in Excel

APPENDIX E

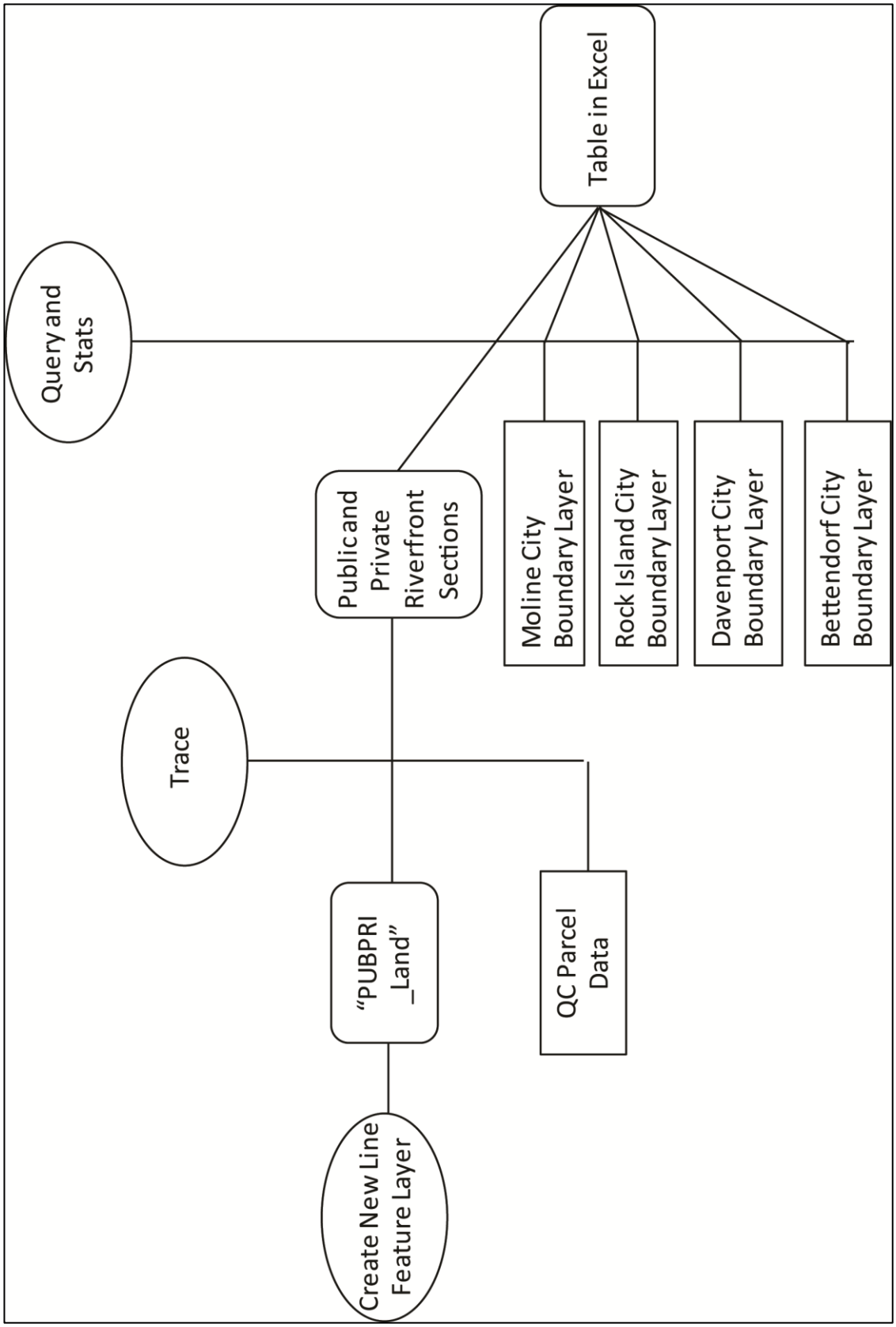
Table in Excel
Query and Stats
Public and Private Riverfront Sections
Moline City Boundary Layer
Rock Island City Boundary Layer
Davenport City Boundary Layer
Bettendorf City Boundary Layer
Trace
"PUBPRI _Land"
QC Parcel Data
Create New Line Feature Layer

APPENDIX F

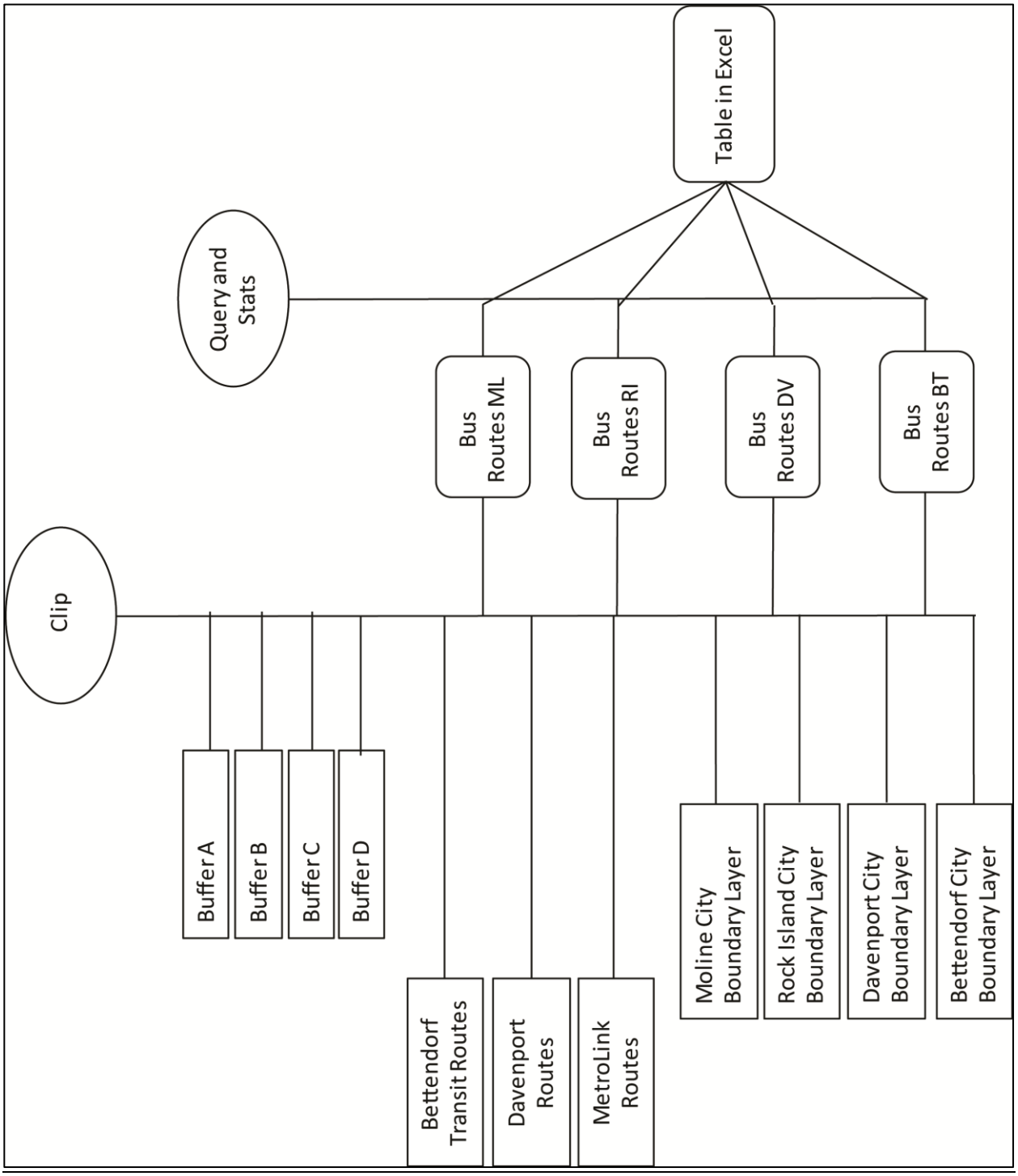
Table in Excel
Query and Stats
Bus Routes ML
Bus Routes RI
Bus Routes DV
Bus Routes BT
Clip
Buffer A
Buffer B
Buffer C
Buffer D
Bettendorf Transit Routes
Davenport Routes
MetroLink Routes
Moline City Boundary Layer
Rock Island City Boundary Layer
Davenport City Boundary Layer
Bettendorf City Boundary Layer

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APPENDIX G

Augustana College

639 38th Street
Rock Island, IL 61201
(309) 794-7000

Dear Participant:

My name is Lorraine Stamberger, and I am an undergraduate student at Augustana College. For my final senior project, I am examining the use, image, and accessibility of the Mississippi riverfronts in the Quad Cities.

Because you are a resident of one of the cities of interest, Rock Island, Moline, Bettendorf, or Davenport, I am inviting you to participate in this research study by completing the attached surveys. The following questionnaire will require approximately 10 minutes to complete. There is no compensation for responding nor is there any known risk. In order to ensure that all information will remain confidential, please do not include your name.

If you choose to participate in this project, please answer all questions as honestly as possible and return the completed questionnaires promptly by mailing the provided envelope (no postage necessary). Participation is strictly voluntary and you may refuse to participate at any time.

Thank you for taking the time to assist me in my educational endeavors. The data collected will provide useful information regarding riverfront accessibility along the Mississippi River in the Quad Cities. The data will be used to assess the strengths and weaknesses of the riverfronts of Rock Island, Moline, Davenport, and Bettendorf concerning use, image, and accessibility. The results of this study will allow cities to better plan future designs and ordinances based on your responses as Quad Cities citizens.

Completion and return of the questionnaire will indicate your willingness to participate in this study. If you require additional information or have questions, please contact my research advisor at the email address listed below.

Sincerely,

Lorraine Stamberger

Advisor: Dr. Chris Strunk, email: christopherstrunk@augustana.edu

This research project has been reviewed and approved by the Augustana College Institutional Review Board, which can be contacted at IRB@augustana.edu.

City of Residence: _____

Length (in years) of Residency: _____

Age: _____

Estimated Annual Income: _____

How often do you partake in the following activities? (Circle the best fit answer.)

1. I use the bike path along the Mississippi River…
    a. Never
    b. Several times a year
    c. Several times a month
    d. At least once a week

2. I eat at a restaurant along the river (within a couple city blocks)...
    a. Never
    b. Several times a year
    c. Several times a month
    d. At least once a week

3. I drive across the river…
    a. Never
    b. Several times a year
    c. Several times a month
    d. At least once a week

4. I visit a park along the river…
    a. Never
    b. Several times a year
    c. Several times a month
    d. At least once a week

5. I go to bars, casinos, sporting events or other entertainment venues along the river…
    a. Never
    b. Several times a year
    c. Several times a month
    d. At least once a week

6. Which riverfront do you visit most often?
    a. Rock Island
    b. Bettendorf
    c. Moline
    d. Davenport

Please complete the following statement with a word, a phrase, or several sentences that first come to mind (use the extra space to elaborate if needed).

7. "I am the Mississippi River in your neighborhood. I am _____."

What dimensions of the Mississippi River do you think are the most important? (Please rank the dimensions from 1 to 6 with 1 being the most important.)

8.

_____ Cleanliness

_____ Naturalness

_____ Aesthetics

_____ Safety

_____ Access

_____ Appropriateness of Development

What are your opinions about the Mississippi River in the Quad Cities Area? (Circle the best fit answer.)

9. Would you consider your city a “rivertown”?
    a. Yes
    b. No

10. Do you have a view of the river from somewhere on your property?
    a. Yes
    b. No

11. Is having a view of the river from your property important to you?
    a. Yes
    b. No

12. Would you consider the Mississippi River in your neighborhood “accessible”?
    a. Yes
    b. No

13. Do you consider it a problem that levees in the Quad Cities can potentially block views of the Mississippi River?
    a. Yes
    b. No

14. Do you consider your property to be in close proximity to the Mississippi River?
    a. Yes
    b. No

15. Do you wish that there were more public parks and spaces along the riverfront?
    a. Yes
    b. No

16. In your city of residence, is it easier or more difficult to access the river compared to the other cities in the QCA?
    a. Easier
    b. More difficult

17. Finally, where would you take someone visiting from out of town first?

    _____

[i] Indicator 1: Number of Access Points within each city boundary (the more access points, the better ranking)
Indicator 2: Population Distribution (the larger population within 1 mile, the better ranking)
Indicator 3: Views from Public Recreational Paths (the higher percentage of path with a view of the river, the better ranking)
Indicator 4: Population within Viewshed (the higher percentage of the population within the Mississippi River Viewshed, the better ranking)
Indicator 5: Percent of Land Use Type (the higher percent of public land, the better ranking)
Indicator 6: Amount of Bus Routes (the higher mileage of bus routes within 1 mile, the better ranking)
[ii] The number are merely ranking and do not hold numerical weight.
[iii] See i.
[iv] Bettendorf and Rock Island have two public boat ramps each, so they both received a 3-ranking.
[v] Buffer A: 0-0.5 miles from the Mississippi River; Buffer B: 0.5 -1 mile from the river; Buffer C: 1-1.5 miles from the river; Buffer D: 1.5-2 miles from the river; Buffer E: 2+ miles from the river
[vi] Buffer A: 0-0.5 miles from the Mississippi River; Buffer B: 0.5 -1 mile from the river; Buffer C: 1-1.5 miles from the river; Buffer D: 1.5-2 miles from the river; Buffer E: 2+ miles from the river
[vii] Based on survey questions 1-5; coded as "Never" = 0, "Several times a year" = 1, "Several times a month" = 2, and "At least once a week" = 3.
[viii] Based on survey questions 7, 9, and 15; coded as "+" if positive response to Q7, if "Yes" to Q9, and if "No" to Q15.
[ix] Based on survey questions 12 and 16; coded as "+" if "Yes" to Q12 and if "Easier" to Q16.